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TELEPHONE ENGINEER

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Volume XXIV *AUGUST, 1920* *Number 2*

Published Monthly, at 53 West Jackson Boulevard, Chicago, Illinois, $2.00 per year.

"The Last Word In Telephone Service Is Automatic Service"

"Your splendid advertisement appearing in 'Telephony' July 10th, I have before me, and it is with pleasure I view the clear cut picture of our automatic equipment of which we are so justly proud for the satisfactory service it always gives.

"The people of Kenton and the nine hundred and fifty rural subscribers of this exchange now know that the last word in telephone service is 'Automatic Service'."

The above letter from W. P. Routh, Superintendent of the Kenton Telephone Company, which has been operating Strowger Automatic Equipment since 1908, is of significance to telephone men for two reasons:

First, it indicates that the announcements and promises made by Automatic Electric Company regarding the performance of Strowger Equipment can be depended upon as representing the true conditions.

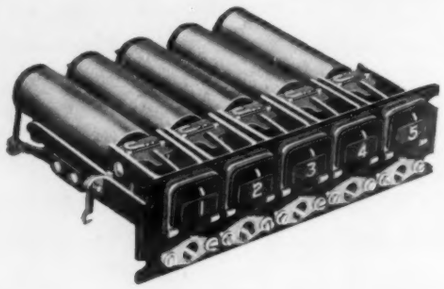
Second, it proves that the service rendered by Strowger Equipment can be depended upon to give satisfaction to the subscribers of any company installing it.

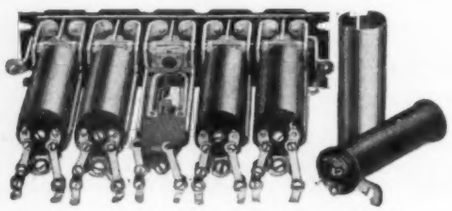
AUTOMATIC ELECTRIC COMPANY, CHICAGO

Associated Companies:

International Telephone Sales and Engineering Corporation, Chicago.
Automatic Telephone Mfg. Co., Ltd., Liverpool.
International Automatic Telephone Company, Ltd., London.
French Thomson-Houston Co., Paris.
Automatic Telephones, Australasia, Ltd., Sydney.

The LEICH switchboard drop with the fixed pole piece and permanently adjusted armature means more to you in the construction of a magneto switchboard than all other so called refinements.





A Dependable Switchboard Must Have a Drop that Will Work at All Times.

At some time during the life of a switchboard it is necessary to remove or replace some of the drop coils.

With the LEICH drop the coils can be changed without affecting the efficiency or adjustment in the least. They have a permanent adjustment and the efficiency cannot be impaired. The coils can be removed simply by loosening one screw.

The jack springs are mounted vertically to prevent the accumulation of dust. This prevents defective contacts.

The night bell can be examined or adjusted from the front of the board and it is absolutely dependable and fool proof.

The jack ferrules can be removed from the front of the board without the use of a special tool.

LEICH switchboard drops take up less space than any other. Less space means a shorter reach for the operator. A shorter reach means faster service.

A LEICH SWITCHBOARD WILL GIVE YOU BETTER SERVICE AND COST YOU LESS FOR MAINTENANCE AND REPAIRS

LEICH ELECTRIC CO.

Telephones, Switchboards, Accessories

GENOA, ILLINOIS

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TELEPHONE ENGINEER

Published on the First of the Month by the Telephone Engineer Co., 53 West Jakson Blvd Chicago $2.00 Per Year
H. B. McMeal Editor: J. M. Graffis Advertising Manager

VOL. XXIV | Chicago, August, 1920. | No. 2

Advocate a Fair Rate for Public Utilities

THE Illinois Committee on Public Utility Information has compiled and published editorial comment from nearly a hundred papers throughout the state advocating a fair rate for public utility services. The committee says. "These editorials are cumulative evidence on the subject and indicate how the substantial citizens of the various communities talk and feel about utility matters. They seem to demonstrate the feeling of self interest, of the newspapers and business men in seeing that nothing shall retard the growth of utilities and that efficiency shall be maintained.

"There is an appreciation that this cannot be accomplished without teamwork of the community served; that where this is lacking the community must suffer equally with the utility as regards prosperity, growth and development."

The Convalescent Telephone

TELEPHONE managers should impress upon their subscribers the necessity of co-operation in the giving of telephone service. The confirmed glooms who always take down the receiver convinced that they are going to get a wrong number are still sure that the particular telephone service given them is the worst possible service, that the equipment is not modern, the operators careless and the management lax.

Getting real service with this attitude of mind is impossible. If these skeptical subscribers were told of the care that is taken to promptly and efficiently handle every telephone call. of the patience and intelligence of the operators, they would have a very different idea of how an exchange is operated.

Telephone service, since the war, is distinctly on the mend, and subscribers should be reminded that a little co-operation and patience from the calling end of a telephone line would do much to bring back the old efficiency.

The Telephone Operator Is a Paragon

THE telephone operator handles impatient, alarmed, stupid, testy, and inconsiderate people and does so with civility and swiftness. Central does not fight or indulge in snappy stuff. "Please" and "thank you" are more used in telephone operation than in any other service.

If anything goes wrong with a telephone calling it is additionally provoking because the offended user has only an instrument to look at and only an invisible agency to scold. He has been taught by his experience to expect that he can turn to the telephone and through it talk to a person with more ease than he could attract that person's attention if he were with him in a room full of people.

The standard of American telephone service is so high that its very excellencies form the basis of the user's complaint when things go wrong.

This service is one of the demonstrations that there is an American genius which can do things and do them right.

Profanity Over Telephone Lines

A PENNSYLVANIA woman has asked the public service commission of that state to take action that will prevent one telephone subscriber from abusing another one over a telephone. The claim is made that the telephone company had failed to abate the nuisance.

The public utilities board of Ohio has ruled that service may be discontinued by a telephone company in the case of a subscriber who uses profane language in talking to the operator or a patron of the company.

These two cases call attention to a practice that is entirely too common with a number of persons in every community. Profanity and abusive language appear to be the stock in trade of the conversation of some patrons of telephone service.

Persons who use profanity on the streets or in any public place, within the hearing of others, can be punished under the law. Why should not the penalty be applied to persons who make use of the telephone to give expression to their fits of temper against others?

Every patron of a telephone service should demand that he receive the protection of the company against abuse from other patrons and the company is justified in discontinuing service if the practice is not abated. The telephone user has no license to be profane or abusive.

An Important Aritcle By Dr. Wolff

WE publish in full in this issue the address of Dr. F. A. Wolff made before the U. S. Independent Telephone Convention at Lake Winona, Ind.

Dr. Wolff is chief of the telephone division of the U. S. Bureau of Standards and anything from him is read with great interest. The telephone section of the bureau, as the bureau itself, is anxious to keep in touch with the interest it serves and welcomes both comment and criticism. It desires the opinion of telephone men, both officials and employees, regarding this work.

An opinion of this kind serves as a valuable guide in planning the work of the bureau.

Erie Hello Girls Live in President's Car During Strike

(Photos by International)

The Erie Railroad officials took no chances in having their telephone service disrupted during the strike and the operators at the Jersey City Terminal who were unable to travel to and from their homes were quartered in President Underwood's special train in the Jersey City yards.

The top photograph shows three of the girls making up their berths after a good night's rest. In the center the girls are shown tidying up the car—and at the bottom they are passing a few idle moments, sewing.

A Method of Simplifying Circuit Diagrams

An Address Before the United States Independent Telephone Convention

By Dr. F. A. WOLFF
Chief Telephone Division U. S. Bureau of Standards

THE Bureau of Standards has been engaged in telephone work for about five years. First of all, we have attempted to cover the whole subject of telephony in its broader aspects. Then we plan to fill out in a detailed way one branch after another. During the past year and a half we have been engaged in the preparation of a circular of information on telephone service. In manuscript form it contains over 200 pages, and it is our intention to send it to those who are specially qualified for constructive criticism and comment before its publication. An idea of the scope and treatment can be formed from the introduction, from which I quote:

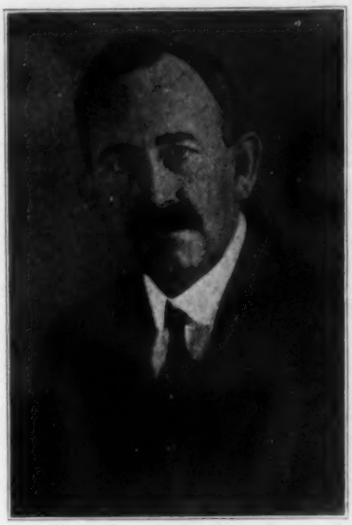
"Telephone service. The product which a telephone company sells is service. Telephone service comprises the furnishing of the necessary telephone plant and the operation of the plant so that any user thereof will, upon demand, be connected to any other user thereof, and the two parties can talk with each other when they desire to do so. The unit measure for telephone service is the completed call or connection.

"Grade of service. In general, the grade of telephone service which a community requires varies with the telephone development of the area. In particular localities special needs have to be considered in the determination of what grade of service should be rendered. In all cases, however, the general satisfaction of the majority of the users is the most important criterion of good service.

"The object of this publication is to describe telephone service in such a manner as to give the reader a fairly comprehensive understanding of what is involved in rendering telephone service and what the elements of the service are which determine its grade.

"The scope of the publication is limited to a general introductory treatment of the subject suitable for those who desire only a brief discussion. A more detailed and more technical presentation is reserved for future publications.

"A brief outline of the development of the telephone art is given first. It serves as a historic background for obtaining a proper estimate of present day achievement, and is explanatory in nature of the descriptions which follow. Only the most important developments are mentioned. Each of these is of a fundamental nature and marks a stage of development, but all of these together cover only a part of the total. The other part includes a very large number of lesser developments, which in the aggregate are of far reaching importance. These pertain chiefly to the choice of materials, improvements in the design of apparatus, and in methods of manufacture, installation, construction, operation and maintenance, to secure greater efficiency, dependability and reduced cost. This type of development has been practically continuous since the invention of the telephone.



Dr. Frank A. Wolff

"The description of the telephone plant follows, and is divided into three parts, which respectively consider the equipment of manual switching systems, the equipment of automatic switching systems, and the construction of the outside line plant. In describing manual switching systems an attempt has been made to cover the most important methods of all the many varieties.

"The description of automatic switching systems is limited to two systems. One is commonly known as the automatic system and the other the semi-automatic system, which is known as the auto-manual system."

There is another automatic system, a description of which will most likely be included.

"All equipment descriptions are given from an operating standpoint and cover the common classes of service. The description of the outside line construction is intended as a view of the completed plant.

"The section on telephone traffic supplements the operating descriptions under plant equipment headings by considering the handling of the calls of common types. This section, however, is mainly concerned with the handling of traffic from a quantitative standpoint and with the basic principles underlying the determination of the amount of plant facilities and number of operators required for handling calls.

"The section on principal elements of telephone service presents the elements in groups designed to bring together the elements having a common service relation. Each element is considered with a view to showing its relation to the grade of service.

Efforts have been directed to thus outlining a basis for future work along the line of service standards, but no attempt has been made in this first telephone publication to formulate any service standards or to assign any values.

"The last section is with regard to public relations, now largely governed by commission regulation. Reference is made only to the more important phases of the general subject, which have received attention."

As part of this work, it has been necessary to study telephone equipment, the way in which it is operated, which includes circuit operation. A large number of types of equipment, manual, automatic, and semi-automatic, have been studied from this standpoint.

The general functions of a switching system are:

(1) To operatively connect a calling station to another station in the system.

(2) To provide for handling the maximum number of simultaneous calls which are offered.

Under operative requirements, I understand these:

(1) To provide a battery supply for signaling, operating, and talking purposes.

(2) To guard the connection while being built up and when completed against intrusion from other lines, and, vice versa, against intrusion on other lines.

(3) To hold the connecting means operative as long as may be required.

(4) To release the connection when no longer required.

(5) To take into account transmission requirements, for instance, the clearing of the line of all attachments which might interfere with transmission.

(6) To advise the calling subscriber when a called line is busy.

(7) To ring the called station and give a report or ringing tone to the calling party.

(8) To discontinue the ringing when the called party answers or the calling party hangs up.

(9) To provide for supervisory signals, both in manual and automatic systems to indicate off normal conditions.

There may be various added requirements imposed, for example, in handling message rate service, party line service, private branch service, toll and information service.

The circuit elements may include jacks, plugs, cords, keys, lamps and other signaling devices; relays and contact springs operated by them; motor magnets, which may also have contact springs; mechanical devices operated by motor magnets; springs operated mechanically at particular stages of the operation, etc.

In considering circuits in the most general way it may be said that the design must provide for proper functioning under all the various operating conditions which may be encountered, and in accordance with a prescribed operating routine.

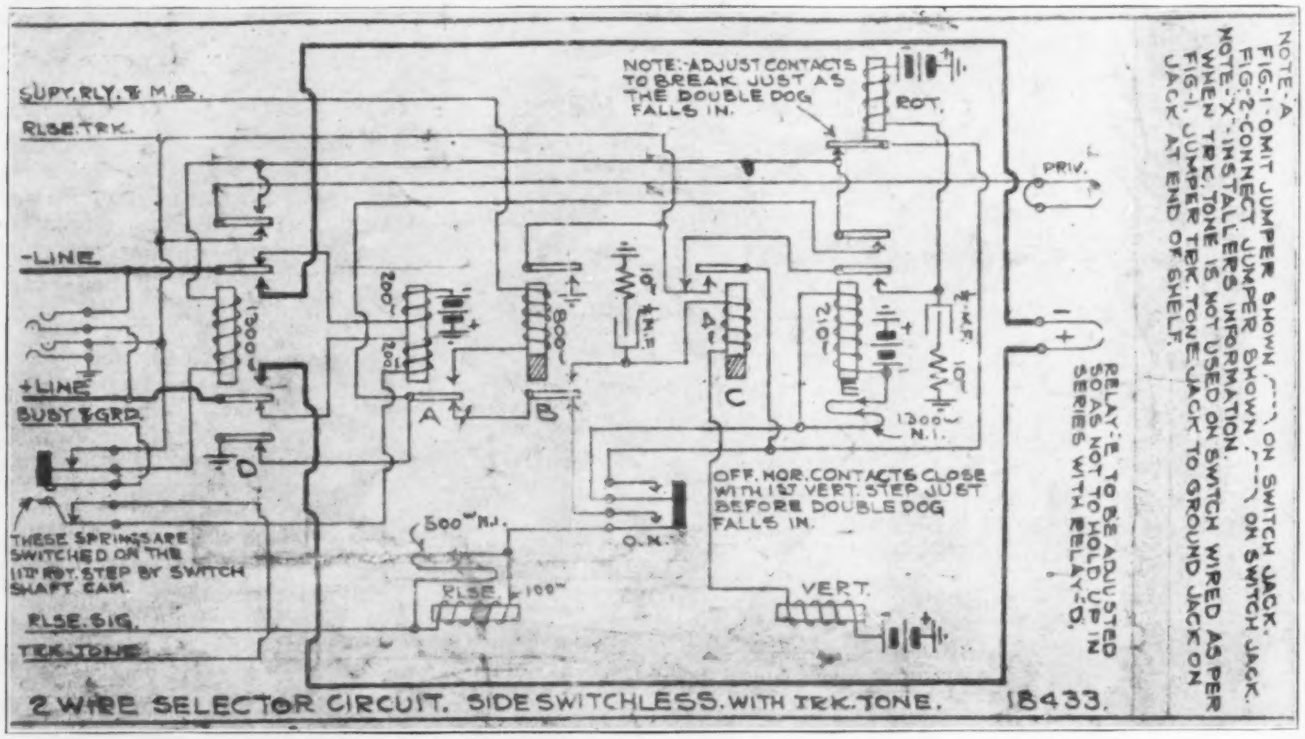
The electrical circuits are opened, closed, prepared or prepared in part for subsequent operation, by the action of relays, having one or more sets of contact springs, or by mechanically operated contact springs brought into play at definite stages of the operation.

The circuits are so designed as to bring about the functioning of the circuit mechanism in a pre-determined sequence in accordance with operating requirements. This can be accomplished in many ways. The aim in general is to design the system as a whole so as to use only two line wires, and a minimum number of cords, switches, relays, relay springs, etc., consistent with efficient operation.

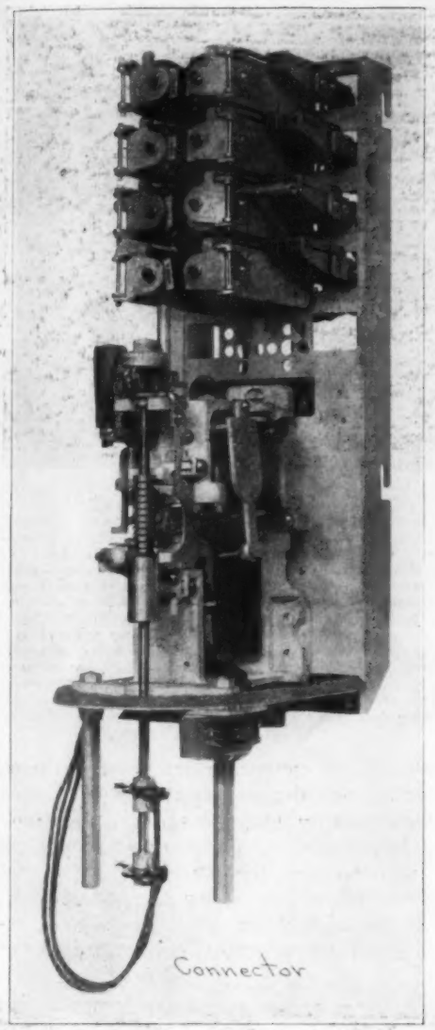
In the Strowger system—I am mentioning this in particular because the diagrams used for illustrating this paper relate to a Strowger system—in order to make automatic selection possible the lines are systematically grouped, and the selection process consists in the step-by-step selection of the particular smallest group in which the called line lies, and then the selection of the called line or station itself.

In a decimally grouped 100,000 line system, we first have to select a particular 10,000 group, then the particular thousand of the 10,000, and then the particular hundred of that particular 1,000 in which the line lies, each step requiring one switch. To select a particular line there are two additional processes of selection, to select the right ten group and the right unit in that ten.

A line switch unit is also provided in this system for the purpose of reducing the amount of switching equipment required, a group of sub-


NOTE: ADJUST CONTACTS TO BREAK JUST AS THE DOUBLE DOG FALLS IN.
SUPV. RLY. & M.B.
RLSE. TRK.
-LINE
+LINE
BUSY & GRD.
THESE SPRINGS ARE SWITCHED ON THE 11TH ROT. STEP BY SWITCH SHAFT CAM.
RLSE. SIG.
TRK. TONE
ROT.
PRIV.
1300~
200~
120~
800~
10~
K.R.
A
B
C
D
210~
1300~ N.I.
OFF. NOR. CONTACTS CLOSE WITH 1ST VERT. STEP JUST BEFORE DOUBLE DOG FALLS IN.
500~ N.I.
O.K.
RLSE. 100~
VERT.
RELAY-E TO BE ADJUSTED SO AS NOT TO HOLD UP IN SERIES WITH RELAY-D.
NOTE: A
FIG. 1 - OMIT JUMPER SHOWN ON SWITCH JACK.
FIG. 2 - CONNECT JUMPER SHOWN ON SWITCH JACK.
NOTE: "X" INSTALLERS INFORMATION.
WHEN TRK. TONE IS NOT USED ON SWITCH WIRED AS PER FIG. 1. JUMPER TRK. TONE JACK TO GROUND JACK ON JACK AT END OF SHELF.
2 WIRE SELECTOR CIRCUIT. SIDE SWITCHLESS. WITH TRK. TONE.
18433.

Conventional Schematic Diagram.



Strowger Connector.

scriber lines, being given access in common to a smaller number of trunks and selectors.

In connection with our studies of circuit operation, a departure from the conventional type of schematic diagrams has been made. The advantages of the form of representation adopted, especially from the educational standpoint, have induced me to present them for your consideration.

The diagrams differ from the conventional types in the following particulars:

1. Relay and magnet coils are separated from their contact springs though properly identified.

2. Contact springs are shown in their operative relation to the circuits which they control or operate.

3. The component circuit elements are arranged so as to bring out as clearly as possible the mode and sequence of operation.

4. Associated contact springs in the unoperated condition are in general drawn parallel; when operated, the armature spring alone is shown inclined.

5. Energized relays and magnets are indicated by magnetic fields surrounding them.

6. Conductors carrying current are indicated by heavy lines.

The result desired can obviously only be attained after a thorough study of the circuit operation has been made. Additional advantage is gained by illustrating the operation in a series of diagrams showing circuit conditions at various stages of operation.

When so drawn, the diagrams may be considered as describing in a particular type of shorthand full details of operation. On this account it has been suggested that they be called "Functionalized Circuit Diagrams".

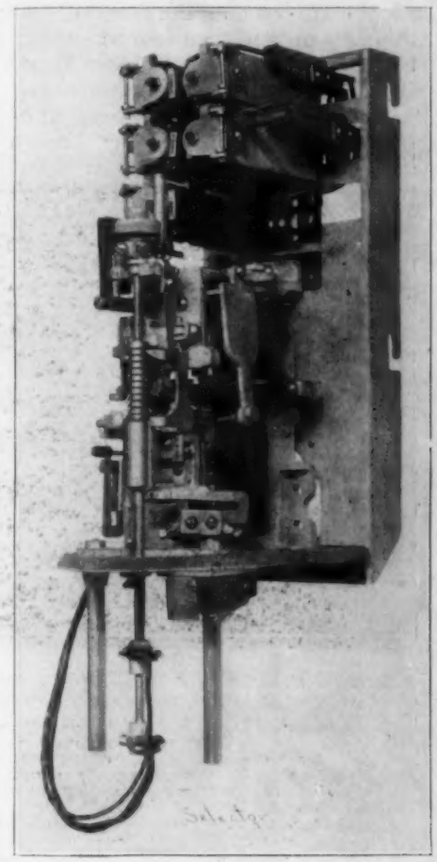
Among the circuits studied are those relating to the plunger type of line and master switch, the selector and the connector. I quote from a brief description of their general functions and mode of operation, as given in the forthcoming Bureau Circular on "Telephone Service".

"Line Switches—Each station line terminates in a device called a line switch and these are assembled in groups of one hundred each. Each line is provided with a line relay just as a manually operated line is, but the line relay on operation closes the circuit of another relay which mechanically connects the calling line to a trunk line. The line switches of a one hundred line group may or may not be divided into smaller groups, depending upon the traffic to be handled. If not so divided, switching equipment for ten outgoing trunk lines is provided to serve all lines of the hundred. If so divided, switching equipment for ten outgoing trunk lines is provided for each such group. The number of trunk lines actually provided for any group, however, depends upon the traffic requirements of the group. The trunk lines run to other devices which operate under control of the dials.

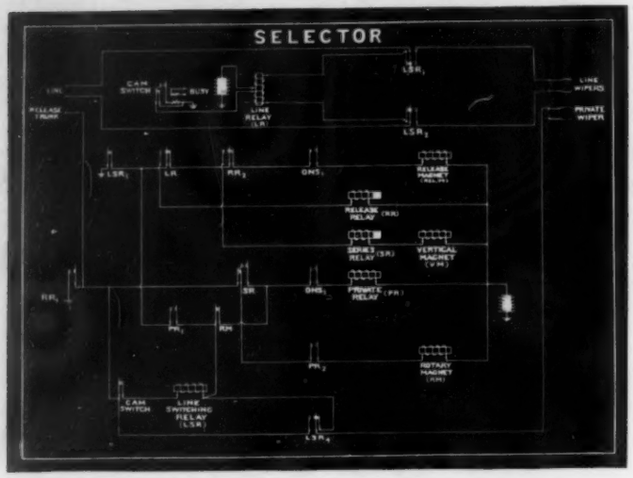
"Each group of line switches has a master switch. The function of the master switch is to so associate each idle line switch mechanism with an idle trunk line switch that when a call is received the calling line will be immediately connected to an idle trunk. That part of the line switch mechanism which effects the connection disassociates itself from the master switch when a call is handled. Immediately after a line is connected to a trunk the master switch moves all idle line mechanisms so as to again associate them with an idle trunk and, in the course of these movements picks up those idle switch mechanisms which previously disassociated themselves from the master switch in order to handle a call and which have been released on disconnection."

"The Connector—The device which can select for connection purposes any line out of a group of one hundred is called a connector. The lines are terminated on flat metal pins arranged in ten rows of ten each, with the rows one above another. Such an aggregation of terminals is known as a bank and each row is referred to as a level. When a telephone with a calling dial is switched through to a connector any one of one hundred lines can be selected by two operations of the dial.

"A dial bears the figures one to nine, and a zero, which is commonly known as the letter 0; it really represents the figure ten. To operate the dial, or to dial, as it is called, the call-



Strowger Selector.

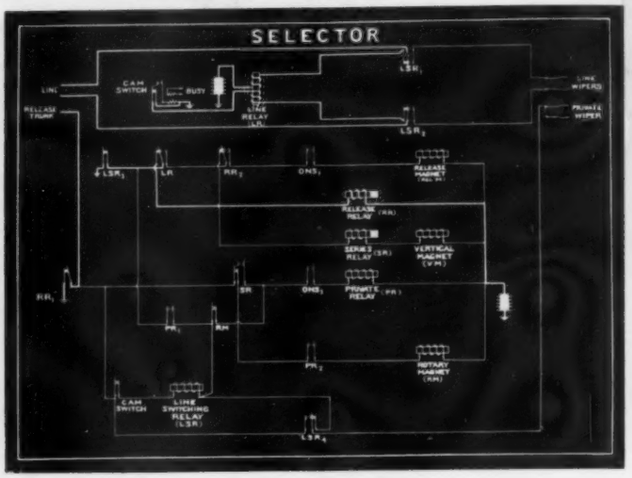


DRAWING I.—SIMPLIFIED DIAGRAM IN NORMAL OR UNOPERATED CONDITION.

I. THE SEIZURE OF THE SWITCH.

1. Line circuit extended; energizing line relay. LR opens contact in the release magnet circuit, and closes release relay circuit. 2. Release relay operates. RR_1 connects ground to release trunk for holding operated switches previously seized. RR_2 opens contact in release magnet circuit and prepares vertical stepping circuit.

The selector remains as shown in Drawing II until first dial interruption.



DRAWING II.—THE SELECTOR SEIZED BY A CALLING LINE.

II. THE VERTICAL STEPPING—First Break of Line Circuit by Dial.

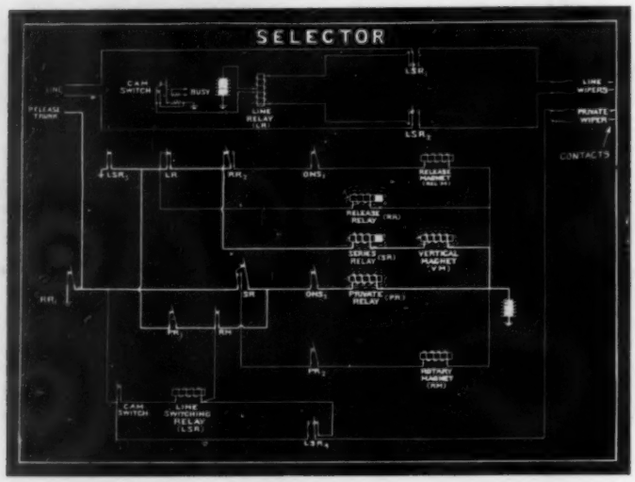
3. Dial opens line circuit. 4. Line relay releases. LR momentarily opens release relay circuit (relay is slow on release and remains operated) and then closes the vertical stepping circuit. 5. Series relay and vertical magnet operate. SR closes a contact in the private relay circuit and opens a contact in the rotary magnet circuit. Vertical magnet lifts the wiper shaft and wipes to level of first row of contacts. 6. Off normal switch operates during vertical step. ONS_1 prepares for subsequent release of selector. ONS_2 closes private relay circuit. 7. Private relay operates. PR_1 closes private relay locking circuit. (Note that line switching relay is short circuited.) PR_2 prepares for the operation of the rotary magnet when series relay releases after last vertical step.

Drawing III illustrates circuit condition at this stage.

ing party inserts a finger in a hole in the movable disc, which hole is directly over one of the figures, and pulls the disc around until the finger strikes a metal stop and then lets go.

The disc returns to its normal position and automatically opens and closes the line circuit a number of times equal to the number dialed. Thus the current which is normally on the telephone line may be interrupted any number of times from one up to ten. The dial is provided with a governor which controls its operating speed and also with a mechanism which short circuits the talking circuit of the telephone during its movement.

"The connector is so constructed that the first figure dialed steps its connecting springs up a number of levels equal to the number dialed, and so that the second figure dialed moves its connecting springs horizontally along the level previously selected a number of steps equal to the second number dialed. As the con-

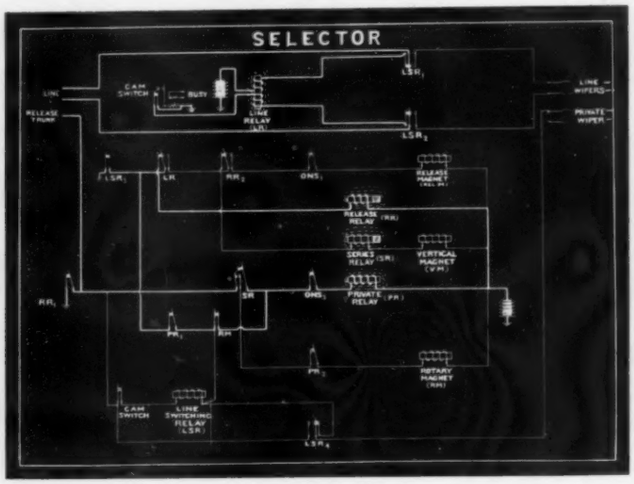


DRAWING III.—CIRCUIT CONDITIONS RESULTING FROM THE FIRST BREAK OF THE LINE CIRCUIT BY THE DIAL.

II. THE VERTICAL STEPPING—(Continued)—Closure of line circuit by dial after first break and operation on succeeding dial interruptions.

8. Line circuit closed by dial after first interruption. 9. Line relay reenergized. LR opens vertical stepping circuit and closes release relay circuit again. (Vertical magnet releases but series relay being slow on release holds.)

If a digit greater than (one) be dialed each break by dial will cause the vertical magnet to lift the wipers one vertical step. The vertical stepping circuit and the release relay circuit will be alternately energized, the release relay and series relay holding until after the last dial interruption. The Drawing IV illustrates the circuit condition just after the last vertical step, the wipers being raised to the desired level.

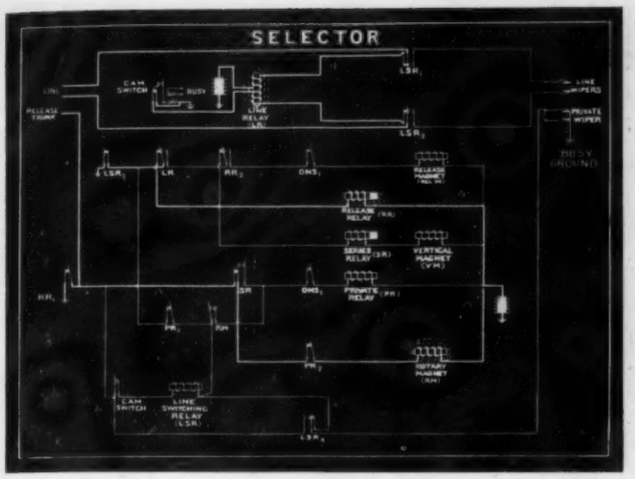


DRAWING IV.—CIRCUIT CONDITIONS AT THE LAST VERTICAL STEP.

III. THE ROTARY OPERATION—First Rotary Step.

10. Series relay releases a brief interval after last vertical step. SR opens operating circuit of private relay and closes rotary magnet circuit. 11. Rotary magnet operates. Moves wipers to engage bank terminals of first trunk on selected level—(assumed busy and therefore has its private contact grounded.) RM *contact springs open circuit of private relay after wipers have been moved one step.*

Drawing V illustrates circuit condition after wipers have taken one rotary step, engaging terminals of a trunk—(assumed busy)—the private relay next functions with the rotary magnet to move the wipers to the next trunk.

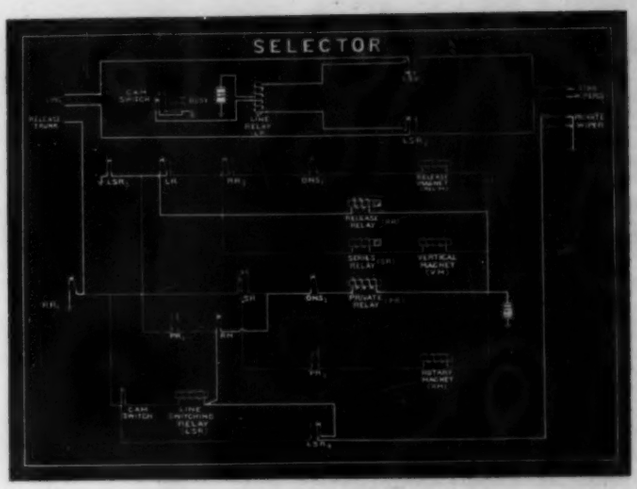


DRAWING V.—CIRCUIT CONDITIONS AS WIPERS ROTATE TO A BUSY TRUNK.

III. THE ROTARY STEPPING—(Continued)—Second rotary step and succeeding circuit actions.

12. Private relay releases (its circuit having been opened at Rot. M.). PR_1 opens contact in private relay locking circuit. PR_2 opens rotary magnet. (Note that line switching relay is short circuited until an idle trunk is found.) 13. Rotary magnet releases. RM again closes private relay circuit, this time to ground on private wiper.

The private relay next closes its locking circuit and the circuit of the rotary magnet causing the wipers to rotate to the second trunk. This interaction of the private relay and rotary magnet will cause the wipers to be rotated step-by-step so long as ground is found on the private bank contact of the trunks. Drawing VI illustrates the second energization of the private relay which, through the rotary magnet causes the wipers to be moved to the second trunk.



DRAWING VI.—ILLUSTRATING THE AUTOMATIC ROTARY STEPPING FROM GROUND OR GROUNDS ON PRIVATE BANK CONTACTS.

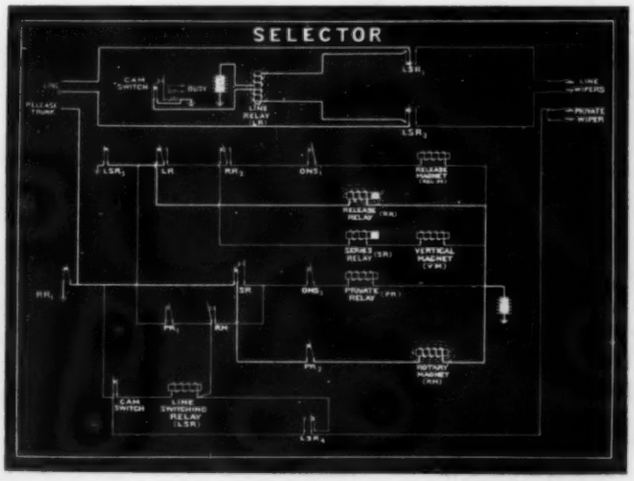
III. THE ROTARY STEPPING—(Continued)—Last rotary step.

14. Rotary magnet operates (circuit having been closed by private relay which in turn was operated from ground on contact of preceding trunk.) Moves wipers to contacts of an idle trunk. Rot. M. opens circuit of private relay AFTER wipers reach idle trunk.

Drawing VII illustrates circuit condition just after rotary magnet has operated for the last time, the wipers being on an idle trunk and the private relay about to release.

necting springs are rotated horizontally they make contact with the terminals of each line, but the mechanism of the connector holds the line connection open during this process. When the action stops the connecting springs will be in contact with the terminals of a particular line. The order of terminating the one hundred lines is such that each can be selected by the above described process. For example, line number 62 would be on the second terminal of the sixth level.

"In a system of only one hundred lines each trunk from a group of line switches runs direct to a connector and as many connectors are furnished as there are trunks required to handle the calls. The lines of each particular hundred group are multipled to all of the banks of the connectors associated with the particular hundred lines so that each connector of

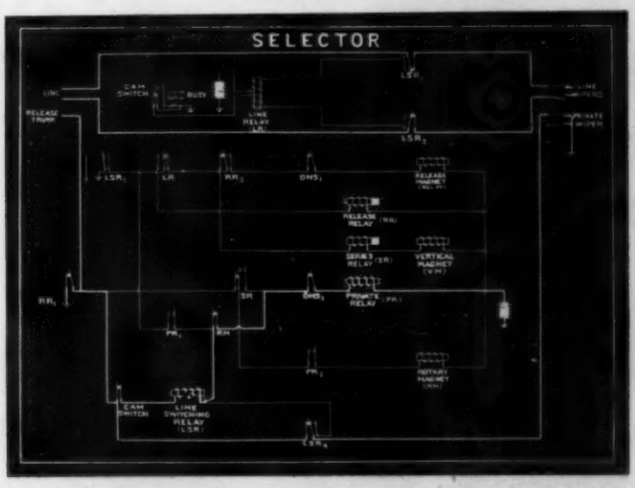


DRAWING VII.—CIRCUIT CONDITIONS AS WIPERS REACH AN IDLE TRUNK.

IV. CONNECTING THROUGH TO NEXT SWITCH.

15. Private relay releases (see preceding drawing) PR_1 takes SHORT CIRCUIT from Line Switching Relay. PR_2 opens Rotary Magnet circuit. 16. Rotary Magnet releases. RM closes circuit of Line Switching Relay and Private relay in series. 17. Line Switching Relay operates. (Private Relay does not operate in this circuit.) LSR_1 and LSR_2 cut line circuit through to next switch, opening circuit of Line Relay of the Selector. LSR_3 opens to prevent premature release of the Selector—Release Relay holds until ground is placed on Release Trunk at Next Switch. LSR_4 extends Release trunk to Next Switch. 18. Line Relay releases. LR returns to normal. 19. Ground is placed on Release Trunk at Next Switch.

Drawing VIII illustrates circuit condition at this stage.

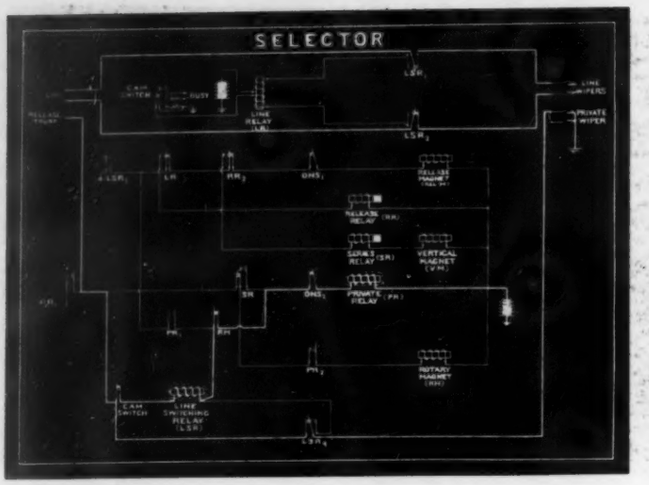


DRAWING VIII.—ILLUSTRATING THE CUT THROUGH AND TRANSFER OF RELEASE CONTROL.

V. SELECTOR IN OPERATED CONDITION.

20. Release relay releases. RR_1 disconnects local ground from release trunk transferring control of release to next switch. RR_2 return to normal, completing the release magnet circuit everywhere except at the LSR_2 contacts, thus giving control of the release to the line switching relay. It is to be noted that the line is cleared of all attachments, and that only one relay remains operated—the line switching relay. The circuit remains thus until the connection is no longer desired, that is, until the calling subscriber replaces receiver on the hook.

Drawing IX illustrates the normal operated condition of the selector.

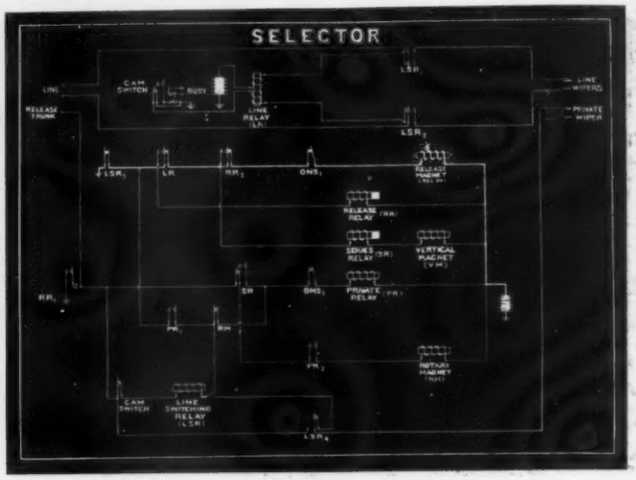


DRAWING IX.—OPERATED CONDITION.

VI. NORMAL RELEASE OF THE SELECTOR.

21. Calling party replaces receiver on hook. 22. Line circuit is opened. 23. Ground is removed from release trunk at last switch seized. 24. Line Switching relay of selector releases. LSR_1 and LSR_2 break through connection of line and again bridge line relay. LSR_3 closes release magnet circuit. LSR_4 restores release trunk circuit to normal.

Drawing X illustrates the release of the Selector as far as the energization of the Release Magnet.



DRAWING X.—SHOWING CLOSURE OF RELEASE MAGNET CIRCUIT.

VI. NORMAL RELEASE OF SELECTOR—(Continued).

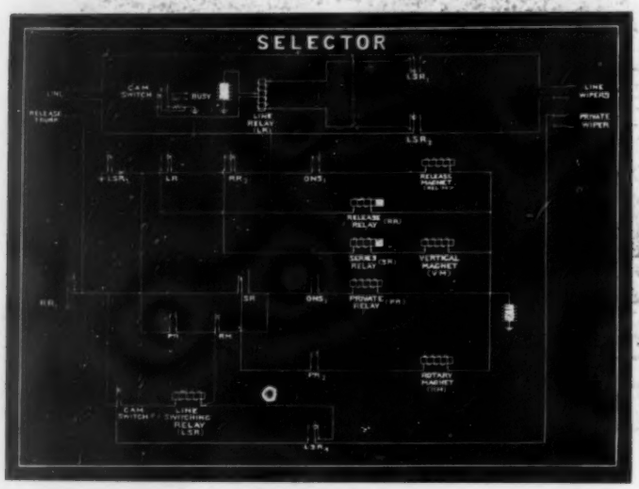
25. Release magnet operates releasing mechanism. Wiper shaft and wipers return to normal, rotary motion being under action of a spring and downward motion under action of gravity. 26. Off normal switch returned to normal near end of downward motion. ONS_1 opens release magnet circuit. ONS_2 restores private relay circuit to normal. The selector is now in the normal unoperated condition ready for re-seizure in the process of another call.

Drawing XI shows this stage.

a group has access to each line of that group. Because of the close association of line switches and connectors, the connectors are mounted on the rear of the frames which carry the line switches.

"*The selector.*—When a central office has many groups of one hundred lines it is evident that before a particular line in any group can be selected the group itself must be selected. In an office having one thousand lines there would be ten groups of one hundred lines each and a choice of the required number of connectors for each group. The selection of a group is made by a device called a selector and each trunk from a group of line switches thus runs direct to a selector. The operation of a selector differs from that of a connector in that the level only is selected by the dial. After a level has been selected the selector automatically rotates its contact springs until it finds the first idle trunk line on that level and then immediately connects the calling line through to a connector. Each level of a selector bank has a capacity for ten lines and thus the bank has a total capacity for one hundred lines, exactly like a connector, but the connecting lines are always trunk lines.

"The trunk lines on the first level run to the connectors of the first one hundred group, the trunk lines on the second level run to the connectors of the second hundred group, etc. Thus,

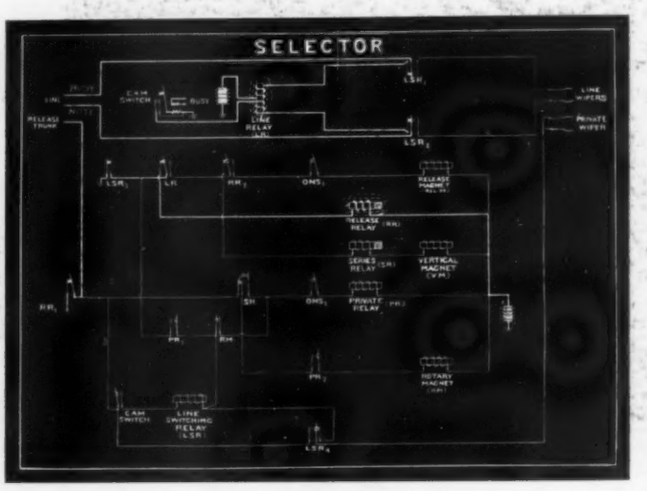


DRAWING XI.—NORMAL OR UNOPERATED CIRCUIT.

VII. OPERATION WHEN ALL TRUNKS ON THE SELECTED LEVEL ARE BUSY

27. The rotary stepping takes place as previously described, the wipers being rotated off the bank contacts by the ground on the tenth trunk. 28. A cam on the wiper shaft operates the cam switch in the eleventh position. One set of springs of the cam switch cause a busy tone to be placed on the line to notify the calling party of the busy condition. Another set of springs open, preventing the operation of the line switching relay.

Drawing XII illustrates the circuit condition when the wipers are on the eleventh rotary step.



DRAWING XII.—CIRCUIT CONDITION WITH WIPERS ON 11TH ROTARY STEP.

VII. OPERATION WHEN ALL TRUNKS ON THE SELECTED LEVEL ARE BUSY. (Continued.)

29. Calling Party hangs up on receiving busy tone. 30. Line relay releases. LR opens release relay circuit and prepares release magnet circuit. (Vertical magnet is energized momentarily but this has no function.) 31. Release relay releases. RR_1 removes ground from release trunk releasing other switches. RR_2 closes release magnet circuit.

The selector now releases and returns to the normal in the same manner as that previously described.

if a telephone with a calling dial is connected to a selector, the first movement of the dial will select a row of trunk lines going to connectors of the selected one hundred line group and the selector will automatically select the first idle one and connect thereto before the calling party has time to dial again. The second and third movements of the dial will operate the selected connector as already stated. Thus any line out of a thousand can be selected by means of a selector and with a choice of the required number of trunk routes to each one hundred lines.

"To meet the average requirements of ten simultaneous connections with each one hundred lines there must be ten selectors through which each group can be reached. Thus the ten trunks from each line switch group each go to one selector. As there would be ten such groups one hundred selectors would be required to serve one thousand lines and each selector would be given one trunk line to each of one hundred connectors."

Selectors and connectors, including types designed to meet special operating requirements have in common three motor magnets; a vertical magnet designed to actuate mechanism for lifting the shaft carrying the contact springs or wipers step by step to the desired level; a rotary magnet actuating mechanism for rotating the shaft step by step for the automatic selection of the first idle trunk in the case of selectors or for the selection, under control of the dial, of the line called in the case of connectors and finally a release magnet for restoring the switch to its unoperated condition.

The predetermined sequence of operation, differing from type to type is affected by the aid of a circuit including the three magnets; contact springs associated with the rotary magnet; a number of relays and associated contact springs; "off normal" contact springs brought into play near the end of the first upward step of the wiper shaft and restored at the same point (when the shaft returns to normal).

The preceding functionalized diagrams and text relating to the selector, prepared by our Mr. C. M. Godfrey, will serve to illustrate some of the advantages of this mode of representation.

Many circuits, manual, including the improved types to which attention has been directed the last few years, full automatic and semi-automatic, of all the leading types and makes have been redrawn in the manner described, thus making it possible to readily trace the circuit operations without the need of the peculiar type of memory required for equal familiarity with the corresponding conventional schematics.

The diagrams have also been found of great value in the preparation of descriptions of circuit operation, which necessarily requires a clear understanding of each successive step. In actual practice the functionalized diagram is in general first prepared in rough outline, and then redrawn so as to best represent the manner of operation.

It has also been suggested that the functionalized circuit diagrams would be of value in connection with the diagnosis of off normal and trouble conditions, as this also requires a thorough understanding of circuit operation, though in the actual location of the trouble a wiring diagram with the usual color codes indicated and the circuit elements shown in their proper spacial relation would still be employed.

Additional advantages of the "Functionalized Circuit Diagrams" are found in connection with circuit analysis and comparative studies of circuits of the same general type or of circuits differing in minor details.

In conclusion the hope is expressed that the Bureau may actively cooperate with the telephone interests in general and especially with the U. S. Independent Telephone Association in stimulating a greater interest in the broader aspects of telephone engineering and in the detailed study of telephone service, as well as in rendering its assistance in facilitating the educational work incident to the introduction of newer types of equipment, which may afford economic relief to hard pressed operators.

New Sterrett and Cheadle Exchange in Clinton

E. S. Sterritt and C. M. Cheadle of the National Telephone & Electric Company plans for the erection of a new telephone exchange building at the corner of Quincy and Adams streets in Clinton, Ill., and for the installation of a modern system in Clinton, entirely replacing the system which is in operation.

Honor Telephone Girls Who Served in War

Ten Michigan young women who served overseas as telephone operators with the American Expeditionary Forces, were honored by the Michigan State Telephone Company and the Detroit branch of the Young Women's Association recently. After taking luncheon with Miss Julie Russel, formerly president of the Detroit Y. W. C. A., who was the association hostess at Chaumont, France, where many Michigan operators served, the operator-veterans were entertained by the company at the theater and then at dinner at the Statler Hotel.

The association had these brave young women as its honor guests at the ceremony attending the return by Miss Russel of the flag presented to her two years ago to take to France. Col. E. M. Stannard, traffic engineer of the telephone company, who directed the telephone and telegraph service of the American S. O. S. in France, spoke, and Rev. Joseph Vance, of Detroit, a chaplain during the war, conducted a brief memorial service for the late Miss Cora Bartlett, of Hillsdale, who died in France and was buried at Tours.

The operator-veterans who attended were Louise Gordon, Louise M. Wilcox, Faye R. Harvey, Amelie Lucier, Mrs. H. Coyle, Marisu Broderick, Martha Carrel, Bertha Carrel, Oleda Joure and Elizabeth M. Shover, of various parts of the state.

Wireless to Give Forest Fire Alarms

With the establishment of eight or ten wireless telephone stations in the wild mountain country of central Idaho, in the Thunder Mountain district, added to the national forest reserves, the government will give the first complete test during the coming summer of the wireless as a means of reporting forest fires.

According to forestry service report, R. B. Adams, wireless telephone expert, who made extensive experiments in Idaho and Montana last season, will have charge of the work.

The Thunder Mountain territory embraces 2,000,000 acres of forest land, which has been added to the Idaho and Payette reserves. It contains some of the most valuable timber in the West, although many million feet were lost last season through disastrous fires. The country is roughly mountainous and almost inaccessible.

From the Operators Viewpoint

A Madison Girl Gives the Other Side of the Problem

By LUCILLE C. SELK

IF there is one individual in America who is getting more unfavorable publicity than an anarchist or a profiteer it is the telephone operator, and, land knows, the poor girl little deserves it!

Service complaints have become household bywords; jokes about Central's waning efficiency have crept into the newspapers and magazines and onto the moving-picture screen. When debates over the latest Senate shortcomings lag for street-car travelers, there is always left the telephone girl on whom to let forth disgruntlement because she can no longer supply numbers as speedily and as bulkily as we demand them.

Attacks like these nettle her pride, but do not prick her conscience.

* * *

A telephone operator for eight years, I am equipped to tell the telephone user why Central is losing track of her mission in the central onslaught we Americans call "business."

For the telephone girl is learning more profoundly every day that the job is going beyond her. The public she serves is the great, rushing American public, a people attuned to the whizz of the one-minute lunch, the clatter of the "L" and the subway and the dizzily descending elevator; a people that amasses fortunes over night; that astounds the world with its physical dexterity—a people whose watchword is speed.

Central is the barometer of public temperament. Her duty is to interpret voice intonations from bass to treble, and she knows the meaning of every pitch by heart.

She serves us at the climax of the day's cares and in moments of high success. When death lies in our home she rings the bell softly. When success comes to us the peal that summons our friends to share the good news is a joyous one, and when we call our best girl who can mistake the flippant, devil-may-care tone that tells Bessie we're waiting on the line?

In time of great nervous tension, such as gripped the nation Peace Day, impatient America couldn't wait for the appearance of the latest extra. It called the newspaper offices directly, and maybe central didn't know before the newsy's voice announced it, that things were looking pretty blue for the opposition.

If I had a dollar for every time I said, "Number please?" or "The line is busy," the wealth of the American telephone corporation piled up in silver would look like an ant hill beside my great pyramid.

* * *

There was a time when switchboard work was the occupation of chumminess and leisure. Women subscribers asked you for mustard plaster recipes, and the chief operator, busy at her desk sewing initials in hope chest towels, never looked up when you came back from your ten-minute relief, perfectly satisfied with the stock company's Wednesday matinee.

Though there are times when she cannot be immediately summoned by the flashing of your receiver hook, Central is still at her prison-like post, perhaps listening patiently to the outburst of some irate subscriber.

I am only "Central," the unknown quantity who is on the job from 1 a. m. to 1 a. m., and who is the target for every cut, insolence and term of endearment to which the telephone world gives vent. Miss Welfare Supervisor behind the mahogany desk in the traffic chief's room cannot tell you—the public—what your nature is as well as I can.

I am still the operator, pulling, plugging, reaching, and jumping eight hours out of every twenty-four, trying to like you members of the public who are so antagonistic to me. Oh, sometimes I come upon the Pleasant Voice, and believe me, it is balm to my tirade-worn soul, ready to sink to oblivion after the day's combat with voices.

It is part of the job of a vigilant and cyclonic supervisor to pounce on an operator with her eternal Report on those calls! Here's a light! Speed up! Answer that flash! Not such an impudent voice! etc.

But when the supervisor is forced to "take the board" herself for any reason she remembers that only the operator doing the work of serving the impatient people can know what a capricious and whimsical public it is to please.

* * *

So when you hurl forth your customary, "Well, Central, did you finally wake up" or "Enjoy your nap?" remember that not for a second is the telephone operator off the job; that every ten feet apart there is a watchful overseer, who travels her ten-foot beat to see that every light, flash and flicker is answered within record time; that over every watchfull overseer there is a more vigilant overseer to intensify the job of watching, and that over the vigilant one there are machines with still greater authority.

"But," says the public, "it took me five minutes to get Central on the line this morning, and then she gave me the wrong number and couldn't get the right number, and I knew they were there because I could see them from where I was standing, and when I did get them—finally—she cut me right off in the middle of the conversation. Why, the service is terrible!"

There are angel subscribers who are always satisfied with your service, there are subscribers who meet you halfway, and there are downright grouches who are never satisfied, no matter how hard you try to please them. Every office has them, every telephone girl is "posted" on them. Central knows that when Mr. Grouch's light comes up she must drop her half-finished connection and minister to the man who gets $100 worth of service each month for $2.

If a day passed without his calling the manager and giving him the usual diatribe, that day would be gala in the history of the office. He begins to flash before the receiver is off the hook. His voice is warped and shrill and pugnacious.

Failure to answer him within three seconds means "You reported!"

I have known subscribers who felt that securing the discharge of an operator whose ability to serve failed to coincide with their ability to demand was a sacred obligation.

* * *

The root of all antagonism between public and operator is the subscriber's failure to realize that besides himself there are thousands as eager to get their "parties" as he is.

When signal lights appear on a switchboard as thick as a patch of stars, it is mortally impossible to answer every calling subscriber in record time. Operators to the left and right of you are there with the long reach to help you out, but even then

it is impossible to serve every one with equal quickness.

Fundamentally, local and toll are alike. Whether you are connecting parties in different streets or in different cities demoniac speed, flawless accuracy and unswerving courtesy are expected of you.

Mr. Business Man in Cleveland forgets that it may take an hour to locate Sam Brown in Chicago, that the operator may have to trace him from a dozen hotel registration books to golf links or winter garden.

He thinks the operator can jab a plug in a jack, ring and have Sam Brown instantly report "Here!" as easily as you can get a response from that most obliging of all numbers—the police station. But not so.

Hundreds of other operators from different cities and states are all bent on the same game of "getting somebody's number;" and in the maze of circuits, out-lines, trunks and a thousand other technicalities there is bound to be a clash or delay.

* * *

Did you ever pick up your receiver and toss off casually: "Central, I have a list of numbers to call. See that I get a little special service, will you?" Of course you have.

But do you know that in order to give you that special service Central has to watch your light ahead of thirty others, must pop out "Operator!" the fraction of a second your light comes up, must drop a half-finished connection and forget numbers on two other calls and miss her chance in the Main circuit to see that you have no cause for flashing? Then when she returns to her dropped parties and says apologetically, "What number, please?" she gets the weary advice to take the cotton out of her ears.

* * *

In the old days five minutes to get a number was a fair record. Today the haste with which an operator is expected to answer is appalling. You say, "Gimme Fairchild 620."

"Fairchild 6—20?" says the voice with the smile.

Up in the exchange the operator makes a quick dash for your number, but before she reaches it Operator 20 to the right comes this way on a lurch, bent on getting 8000. Now 8000 is high and requires a reach which drags No. 20's shirtwaist three inches out of the belt. Operator 20 poises the tip of her cord on the rim of jack 8000, but before she can give it the little push that places it, down it tumbles, and the straining job of reaching has to be done all over again. She falls back to her position and you go on after 620.

The line tests revertible busy, but you know it can't be possible. You split the connection and test separately to make sure you don't give Mr. Subscriber the wrong report. Yes, it's a clear, busy test.

"The line is busy," you say pleasantly.

"What!" he screeches, "and it took you all this time to find that out? Well, good"—and he bangs the receiver up in your ear with a crash that makes the drum vibrate so rapidly as to nearly give out under the strain.

* * *

Yet the "hello girl" must smile—never laugh—just smile. If she comes in on the line with such an irregularity as a laugh on her lips, you infer it's no wonder "the service is punk when those operators have time to carry on so!"

* * *

Ten years ago telephone operators had what might be called a personal following. At Christmas the Electric Railway Company sent them pound boxes of candy, and the manager's wife gave each of them a hat-pin holder done in baby blue. Yes, and I can even recall one Fourth of July when the City Creamery sent up three gallons of ice cream, and the Shapiro Fruit Company five watermelons just off the ice.

In those days the telephone was an instrument of socialization. Men and women had not yet exalted it to that pinnacle of service it now occupies throughout the world. Central would obligingly cut off two parties to accommodate another whom she thought had waited long enough, or go so far as to deliver messages between calls.

She rang the farmers and train catchers and alarm clock disregarders, and came in for no small share of socializing herself. In that day her voice was a pleasure—soft, well modulated, a past master in the seductive drawl.

* * *

Today one operator's voice is every operator's. Central has reverted to a mere machine, has lost her identity. Upon being accepted as a satisfactory applicant for telephone work, she is entered into a machine-like school, where she is taught machine-made phrases and stock courtesies. The school turns her out fundamentally equipped for "listening in."

Here what personality remained to her is lost in the magnificence of efficiency belonging to the operator who is her coach. She becomes in one week as glib with her "Numbah plee-aze!" and pugnacious "op-ri-dah!" as her confrere at the right establishing fifteen connections a minute.

It is not her fault. The reversion of the telephone as a luxury to a business necessity has caused it. The nearer and more indispensable to the public the telephone has become, the farther away and more machine-like the operator has grown.

Traditionally, the "hello girl's" greatest earmark is "sassiness." Some operators are born with this weapon of self-defense, and those who are docile natured when they enter the telephone office are professionals at tart repartee before they leave.

The average subscriber cannot understand the blood-boiling sensations that surge through an operator when she must remain mute under the insolence of his remarks. "And conversely he cannot understand the soul-satisfying thrills she experiences when she gives it back to them—as the quickest and sauciest operator I know says—"in cold cash."

* * *

It is the fault of the job because that job is a meeting of voices and not persons. If a subscriber had to appear in person before the operator to get a number, he would undoubtedly be a most courteous subscriber. But when he has to confront only a voice, he has ever so much more courage at upholding his cause, and not to be slack in the game of competition Central also had to hold hers.

The telephone girl has been idealized. She has been put into verse and melody. She has been the last stand and turning points in the tale of adventure and romance. In time of flood, fire, sickness, or accident, her voice has never failed to respond to the flash of the receiver hook.

Time has changed her woefully for some of us. No longer does she dole out railroad time or baseball scores or election returns or train schedules, or even help to while away some lonesome traveling man's evening.

Accelerated business conditions have turned her into the efficient business machine, and she plays her role to the letter from the sounding of the gong which ushers her in file to the operating room to the gong which ushers her out at the end of the day.

The Trouble With Utility Regulation

To Judge an Intricate Subject Intelligently One Must Have an Intimate Knowledge of It

By G. W. CUMMINGS

NOT long ago the writer heard the legal representative of a large municipality make the astounding statement to a state commission that because the authority of the commissioners was delegated to them by the legislature, whose members were elected by the people, and they were therefore, in a sense, "delegated" representatives of the people, they should decide the pending rate case in that city in accordance with the wishes of the people as interpreted by a recent election in which the city administration had won a sweeping victory.

The propriety of giving any consideration to the facts of the case, or to the irreparable damage to the interests of the people which must result from crippling the utility, did not appear to enter his mind. His theory seemed to be that a representative of the people should be not a leader but a rubber stamp, whose full duty was discharged in registering the more or less manufactured and therefore fleeting popular impulses of the moment, without regard to the ultimate consequences. That theory needs only to be stated to show its utter absurdity and its disregard of all the principles on which popular government is founded. For that reason it is seldom brought out so clearly as in this case, but because it does insidiously permeate our political life and affords a fruitful means of exploiting the people by the demagogues it is perhaps fortunate that the attorney referred to was indiscreet enough to bring it out so plainly.

What is the matter with public regulation? Why was the railroad service so demoralized that in order effectively to conduct the war the government was forced to take over the roads and operate them in defiance of the laws and regulations which it had previously laid down? Why was one of the most essential utilities of Chicago reduced to such extremities that its credit, according to sworn testimony of bankers, was destroyed, and only the imminence of a complete cessation of its service brought a tardy relief over the vehement protest of the city administration? In the latter case the mayor was quoted in the daily press as stating that "you have only to consider who appoints the commissioners who made the ruling" in favor of relief. The humor of his statement lies in the fact that he had just emerged second best from a bitter political contest with the governor.

We say that it is politics, and let it go at that, which is about as efficacious as it would be to say that one is sick, without diagnosing the disease or applying the proper remedy. There is a cause and a remedy for every ailment, and so let us apply the microscope and endeavor to discover the germ of this disease. Incidentally, we may find that it is also responsible for many other of our political ills.

It is an axiom of well-ordered society that every individual should do that work for which he is best fitted. To become well-informed and expert on all subjects is a task far beyond the capacity of the most gifted of men, to say nothing of the people as a whole, whose opportunities are necessarily limited. For advice and direction in regard to my physical well-being I go to a physician; in legal matters, to a lawyer; in technical matters, to an engineer or scientist; in financial matters, to an economist.

In my personal affairs I would strenuously resent being required to submit to a popular vote the question of what remedy I should take for my ailment, or what stress to provide for in the bridge I am building. Not that I would distrust their good intentions, but I need and am entitled to the wise counsel of men who have devoted their lives to the acquisition of specialized knowledge along these several lines. It should not be necessary to point out that the advice of such men is as likely to result in success as is the verdict of a popular vote on matters of such specialized knowledge prone to lead to disaster. It is simply a question of whether or not one has a sufficiently intimate knowledge of the subject to judge intelligently. And yet when we come to the vastly more intricate problems of public affairs, including the rates and operation of public utilities, we naively apply to them the method which we recognize as silly and dangerous in personal affairs.

It is urged that because they are public affairs the principles of popular government demand that the people have the deciding voice. So far from that being true, I think that we shall find that such action is subversive of all the principles under which popular government can exist, at least for any length of time. Not only that, but it violates the elementary principle of commonsense referred to above, that to judge an intricate subject intelligently one must have an intimate knowledge of it.

To pretend that the public as a whole can have such a knowledge of the details of public affairs is either absurd or disingenuous. To attempt to settle such matters by a referendum, or its equivalent, the election of public officials on an "issue", not only produces chaos, extravagance, and corruption in public affairs, but strikes at the very basis of popular government by transferring the power from the people to an actual "ruling class", who owe this distinction not to their integrity or qualifications as public servants but to their ability and willingness to manipulate the issues to their own aggrandizement. Could any method more utterly subversive of the success of popular government be imagined than one which puts such a glittering premium on incompetency?

Let us take a rate case as an illustration. Assuming that the management of a utility company is reasonably efficient, and that various classes of service are offered which adequately meet the needs of the subscribers, the fixing of a proper rate is a matter of arithmetic, not of rhetoric. Salaries and wages cost a certain amount, which is shown by the books; so do materials, taxes, depreciation, and the various other expenses, including the "wages of capital". The rates should be so adjusted that they will produce a revenue equal to the sum of these items, plus a reasonable margin for contingencies such as is allowed in every engineering calculation for possible errors in judgment or change in conditions.

Where is there any place in the solution of this problem for stump

speeches or long-winded argument over legal technicalities? Where is there any room for any division between the real interests of the people and the company? Rather there is need for an intimate knowledge of the facts as shown by the books and of the operating conditions, and for sound engineering judgment to interpret them aright in the common interest of the people and the company. As a matter of fact, the real issues have been obscured and the commonsense view of the situation suppressed by a deliberate propaganda fostered by the "ruling class" to keep themselves in power. Surely the reductio ad absurdum of the whole matter is to submit to a popular referendum, as has been done in some cases, the question of whether the people would rather pay five, six, or seven cents for a street car ride. How would you vote in such an election, knowing nothing of the arithmetic of the problem?

Lest I be understood as referring to certain individuals or parties rather than to fundamental principles of government, I shall endeavor to be more explicit, even at some risk of repetition. Like most engineers, I desire to keep as far as possible from the turmoil of politics, but we must recognize the fact that the public utilities have been made a political issue, that there is a wide-spread attempt to solve their problems by political rather than by business methods, and that their most serious difficulties in operating and financing have been the result of this policy. This appears to me, then, a proper subject for an engineering study, and this article is written solely in that spirit.

The propaganda to which I have referred is summed up in the oft-repeated claim that the doctrine "the people must rule" means that the people must pass on the details of all questions affecting the public interest, either directly in a referendum or indirectly by voting for candidates who are pledged to certain policies rather than selected for their ability. This is a subtle flattery in that it attributes to the people an omnivorous knowledge which they cannot possibly possess, and it has been insinuated into our consciousness so persistently and so cleverly that it has come to underlie much of our public thinking. I have endeavored to show that it is a logical absurdity, and that it results inevitably in disaster to the interests of all. It is, I believe, the germ of the disease which we set out to find, and while that disaster may be nature's antitoxin which will in time destroy the germ, the process is long and painful. Most germs produce their own antitoxin, but without help from the physician the patient not infrequently dies in the meantime.

What is the remedy? I am going to out-Trotzky our Russian friends and propose a revolution. Did you ever look up the original meaning of that word, which is still its meaning in the arts and sciences? It comes from the Latin re-volvere, and is defined as "the act of revolving or turning completely around, so as to bring every point of the turning body back to its first position; a complete rotation through 360 degrees". That is what the Russians did, and by removing all the restraints of civilization they thought to leave every individual free to do as he pleased. A pretty theory, but it resulted as it always has and always will in mobocracy, and if there is one indisputable lesson in history it is that mobocracy tends inevitably to an autocracy more rigid than that of any czar. My revolution is more promising than that. We have swung far from the principles on which this government was founded, and I propose to hasten the formation of an adequate antitoxin (ask your doctor what I mean) by completing the rotation back to the starting point.

Let us be frank with ourselves. We prate of our glorious constitution, but how many of us have ever really read it, at least since we reached the age of discretion? I admit that I did not until recently, and I found it a very different document from what, under the influence of current fallacies, I had supposed it to be. Aside from the relations with the states and with foreign governments, I found that it provided simply for the election of an executive and a legislative branch and the appointment of a judiciary, nothing more.

If you want to know what that means to a lawyer who has studied it long and carefully, read that brilliant book of my friend Atwood, "Back to the Republic". To an engineer, it means a government by experts, who are chosen not because they manipulate public sentiment for their own profit but because they are able and willing to bring to bear on questions of public interest a trained judgment enlightened by experience. That is real responsible government, responsible not in the sense of punishment in case the public fail to appreciate all of the logical steps by which they arrive at their conclusions, but in the sense of accepting responsibility for the quality of the work they are chosen to do, instead of dodging it and "passing the buck" to a popular sentiment which is swayed emotionally back and forth by the "ins" and the "outs".

We hear much about the advantages of a short ballot and simplified elections. The Constitution contemplates a shorter ballot than any of our present-day reformers have thought of, and one which would prevent our public officials from evading responsibility under the camouflage of loose organization and confusion of issues. To business men, it would mean that they would be dealing with men who are free to exercise their best judgment instead of thinking of the next election. To the people as a whole, it would be a safeguard against inefficiency and corruption, and by eliminating the demagogue it would enable them to vote intelligently and in their own interest.

Utopian? Idealistic? Perhaps it sounds that way, and yet we have just that form of representative government in every large corporation, and it works. The only thing that keeps us from it in public affairs is the fact that we have surrendered our liberties to a ruling class of professional politicians whose interests lie in keeping the public in ignorance by be-fogging the issues.

It is futile to defeat one boss by electing another, but we can eliminate them and regain our liberties by discarding the present-day fallacies which they have imposed upon our thinking, by going back to first principles, and by electing competent men and then leaving them free to develop and exercise their best judgment by keeping our hands off the details, just as we do in the employment of a physician or any other trained specialist. Then, and only then, can the regulation of our utilities be put on a sound business basis, and our service become what every utility operator hopes to make it. In the meantime, let us support every commission which is seeking to exercise independent judgment and to solve its problems on the merits of each case regardless of the attacks of the politicians.

Here lies the bones
Of William Welt;
He climbed a pole
Without a belt.

A New Alternate Current Potentiometer

For Measurements on Telephone Circuits

By P. O. PEDERSON

THERE has of late years been no scarcity of alternate-current potentiometers suitable for measurements on telephone circuits.

It may, therefore, perhaps seem a little superfluous to increase the number further. Still, I hope that the new one of which a short description is given below, has some features of its own and may even have such small merits as will justify this publication.

The essential part of the new alternating-current potentiometer consists of the well-known, non-inductive, combination, shown in Fig. 1, of two resistances $R_1=R_2=R$ (ohms), a coil L (henry), and a condenser C (farad), where

$$R_1=R_2=R=\sqrt{\frac{L}{C}} \text{ (ohms)} \quad (1)$$

The resistances R_1 and R_2 are formed as slide wires either stretched longitudinally or wound non-inductively on a drum, the return wire in this case being of copper. Each wire is provided with a scale and with a sliding contact—a on the coil resistance and b on the condenser resistance (*see* Fig. 3). The frequency is denoted by n; $\omega=2\pi n$ being the pulsatance. In the above formula (1) R is, of course the effective resistance at the frequency used.

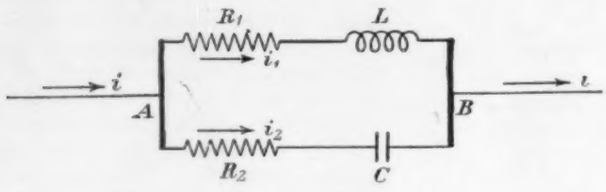


Fig. 1.

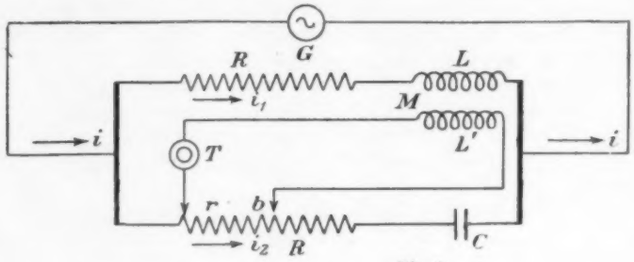


Fig. 2.

Let i_1 be the current through the coil, i_2 through the condenser, and i the current in the main circuit.

We have then

$$i_1=\frac{1-j\omega CR}{1+\omega^2C^2R^2}i;\quad i_2=\omega CR\,\frac{\omega CR+j}{1+\omega^2C^2R^2}$$

$$i=j\omega CR\,.\,i_1 \text{ (amps<)} \quad (2)$$

The current i_2 is thus exactly 90 degrees in advance of i_1 for all frequencies for which the relation (1) is satisfied.

In order to test if the current i_1 is lagging 90 degrees behind i_2 the diagram sketched in Fig. 2 may be used. A coil L^1 is coupled inductively to L, the mutual inductance being M. In series with L^1 is inserted a telephone T and a part r of the resistance in the condenser circuit. The telephone will then be silent if

$$r=\frac{M}{CR} \text{ (ohms)} \quad (3)$$

This value of r is thus formally independent of the frequency. When C is an ordinary mica condenser, and L an ordinary good induction coil, the relation (1) is so nearly independent of the frequency that the telephone in Fig. 2 without altering the position of the sliding contact b will be practically silent for all values of ω between 4,000 and 7,000.

The pulsatance ω may easily be determined in the manner indicated in Fig. 3. A coil L_0 is inserted in the main circuit and another coil L_0^1 coupled to L_0, the mutual inductance being M_0. In series with L_0^1 is the telephone T and the sliding contacts a and b. The telephone will then be silent if

$$a_0=\omega^2CRM_0 \text{ and } b_0=\frac{M_0}{CR} \text{ (ohms)} \quad (4)$$

while the pulsatance may be determined by

$$\omega=\frac{1}{CR}\,\frac{a_0}{b_0} \text{ (radians per second)} \quad (5)$$

The position of the contact b is thus independent of the frequency, and may—for a constant value of M_0—be ascertained once for all. For the measurement of the pulsatance it is then only necessary to find the corresponding position of the contact a.

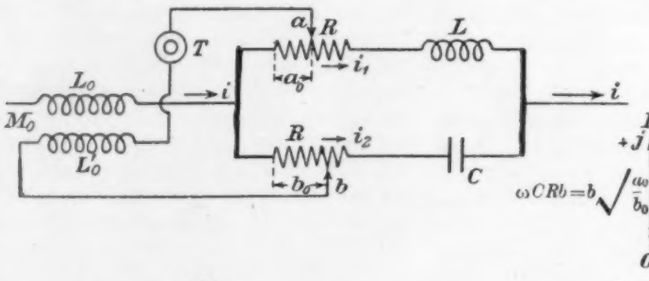


Fig. 3.

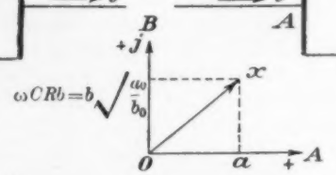


Fig. 4.

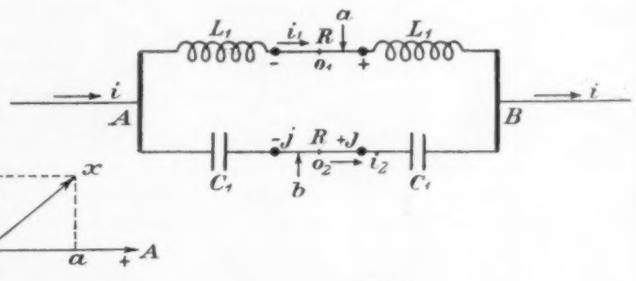


Fig. 5.

Let OA in Fig. 4 be the real and OB the imaginary axis of a rectangular system of reference and X a point,

the co-ordinates of which are a and $\omega CRb = b \frac{a_0}{b_0}$, a and b being the readings at the sliding contacts. The vector OX then represents the potential difference between the contacts a and b. In this way all potential differences falling in the first quadrant are easily compared. But, in order to compare all possible potential differences it is necessary to duplicate the arrangement shown in Figs. 1 to 3 and use two coils, L_1 and two condensers C_1, as shown in Fig. 5. If

$$L_1 = \frac{1}{2} L, C_1 = 2C, \text{ and } R = \frac{L}{C}$$

the current distribution will be exactly the same as in the former cases. The readings at the contacts a and b may now be both positive and negative, counted from the central points o_1 and o_2 of the resistances, o_1 and o_2 being at the same potential. In order to bring the "electrically" central points o_1 and o_2 to fall at the zero marks of the sliding wires, the small slide resistances r_1, r_2, r_3 and r_4 (Fig. 6) are introduced, which resistances are also very convenient in order to satisfy the conditions,

$$R_1 = R_2 = R = \frac{L}{C}$$

If it is not wanted to use the apparatus for frequencies outside a range of, say, from $\omega = 4{,}000$ to $\omega = 7{,}000$, these four resistances may be replaced by four small resistance coils.

The apparatus may now, as sketched in Fig. 7, be used, for instance, for the measurement of impedances. The unknown impedance X is inserted in series with a known impedance R_0 and a coil L'_2 forming the secondary of an air-core transformer having L_2 as primary coil. The mutual inductance M_2 is adjustable and is given such a value that the readings at a and b get suitable values. The ratio of the unknown to the known impedance is equal to the ratio of the corresponding potential differences as measured by the readings of the contacts a and b.

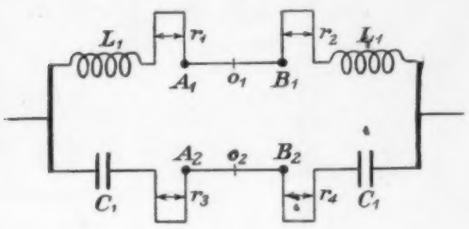


Fig. 6.

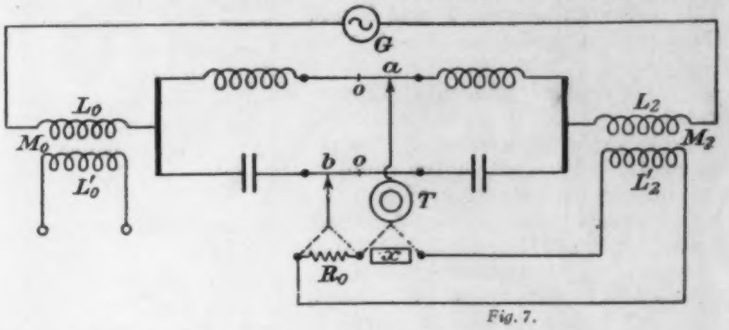


Fig. 7.

The measurement of impedance may be made even more simple by the use of the arrangement sketched in Fig. 8. A circuit I contains the unknown impedance X, the primary coil L_3 of an air-core transformer T_3 and the alternating current generator, or the secondary of a transformer T_4, the primary being connected to the alternating-current generator. Another circuit II contains the coil L'_3 being the secondary of T_3, the potentiometer circuit AB and an impedance Z. This impedance is given such a value that the current i_1 in the coil side is in phase with the current i_3 in circuit I. If, then, the impedance X is a pure resistance the position of b will be at o and the reading at a will The mutual inductance M_1 of L_3 and L'_3 may now be given such a value that the value of X in ohms is equal to the reading at a, that is, to the number of divisions between o and a on the scale along the wire, which number we also denote by a. (In some cases it is more convenient to make the measured resistance equal to $a.10^{\pm 1}$.) If instead of being a true resistance, X is equal to $R' + jX'$, these two components of the impedance are determined by

$$R' = a \text{ (ohms)} \qquad (6)$$

and

$$X' = b \,.\, \omega CR \text{ (ohms)} \qquad (7)$$

If the constants ω, C and R are chosen in such a way that

$$\omega CR = 1,$$

the last equation is reduced to the simple form

$$X' = b \text{ (ohms)} \qquad (7')$$

In that case the *values of the resistance and of the reactance of an unknown impedance are given directly in ohms as the readings at the contacts a and b respectively.* (Fig. 8 *III.*)

The impedance Z may also be chosen in such a way that we get

$$R' = b \text{ (ohms)} \qquad (6')$$

and

$$X' = a \text{ (ohms)} \qquad (7'')$$

The potentiometer may be used for

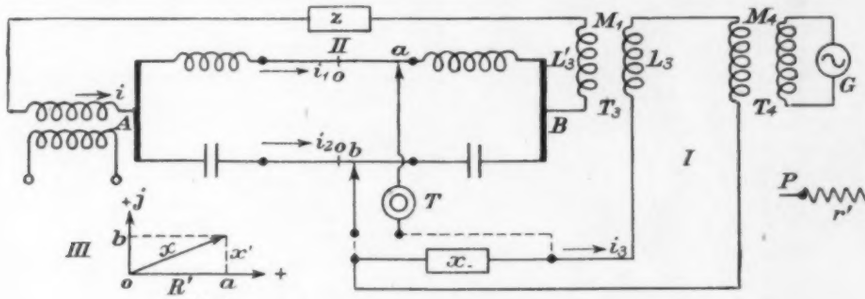


Fig. 8.

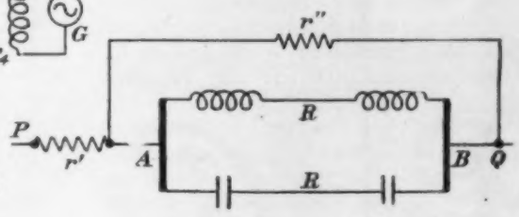


Fig. 9.

many other measurements, which need not be detailed here.

The potentiometer circuit AB has the (non-inductive) resistance R. It will often be more convenient to shunt the potentiometer circuit instead of reducing the mutual inductance M_1. Let AB be shunted by a resistance r'' and a resistance r' be inserted in the main circuit (Fig. 9). The resistance between P and Q will then remain equal to R, if $r' = \frac{n}{n+1} R$, and $r'' = \frac{R}{n}$, and the currents in the potentiometer will be reduced $(n+1)$ times by the shunt.

Example of the choice of the different electrical constants: $L = 0.02$ henry ($L_1 = 0.01$H.), $C = 2.10^{-6}$ farad ($C_1 = 4.10^{-6}$ farad) $R = \frac{L}{C} =$ 100 ohms. In this case we have $\omega CR = 1$ for $\omega = 5{,}000$.

U. S. Boys Best Wireless Operators

Boys of the United States make the best wireless telegraph operators in the world. In no other country besides does the average boy know so much about wireless or take so keen an interest in it. Before the war the United States contained 175,000 wireless stations, large and small, scattered throughout every section of the land. Most of these were amateur wireless stations built and operated entirely by boys. No country in Europe has anything like as many stations.

During the war it became necessary for the government to close most of these wireless stations and regulate the others very rigidly to prevent any enemy using them for his own ends. Now that the war is happily over the government has removed the restrictions, and any American boy is free once more to equip and operate a station of his own. The interest in wireless telegraphy is reviving by leaps and bounds, and in a short time we will see more wireless stations in operation than ever before.

Dr. Millener was in charge of the development of ground service of the wireless telephone in Washington during the war. When he took charge the radius of the telephone was one and a half miles, and when he completed his work the distance had been increased to 50 miles.

Telegraphy by Earth Currents.

If an electric current is sent into the earth at one point and leaves it at another, it travels from one point to the other, not in a straight line, but along a series of curved paths. If the two free ends of two wires attached to a receiving instrument are inserted into the earth at some distance from each other, and not far from the earth current just mentioned, they will have a difference of potential and a current will flow through the receiving instrument. If it is a telephone current which flows through the earth, and if the receiving instrument is a telephone, then in the latter may be heard the passage picked up from the earth. To magnify the sensitiveness of the receiver the French introduced the "Low Frequency Amplifier," three valves in cascade, with total magnification of 125, by which telephone conversations could be overheard at a distance of several thousand yards. The Huns captured one of the valves, saw the purpose of its use, and at once applied it themselves. There ensued a war of wits, each side endeavoring to overhear the messages of the other side and to keep its own messages from being intercepted. By the "Fullerphone" messages could be sent by the Morse code without danger of being picked up.

By picking up current from the earth signal messages were sent from one part of the Allied line to another. The secondary of a "Bower Buzzer" (weight 6 pounds and fifty times as strong as a telephone buzzer) was earthed at both ends. The receiving amplifier was likewise earthed at two points about 200 yards apart. The nature of the soil determined the distance over which signals could be sent. In the muddy soil of Flanders the range was 2,000 yards under conditions for which the range on the Somme was doubled. The reason was that in the latter region, which has 6 feet of earth with chalk beneath, the electric currents were confined chiefly to a surface layer.

To Install Automatics in Pittsburgh

Installation of automatic telephones in all Pittsburgh exchanges is contemplated by the Bell Telephone Company. A new building to be used as the Hiland exchange is to be so constructed. The announcement was made by Charles H. Lehman, district manager of the company.

The new exchange is to be built within four years and with its new equipment will cost several hundred thousand dollars. Property has been purchased in the East End district. Mr. Lehman said installation of the automatic system through the city would be gradual.

Stop Using Word "Party" on Oklahoma System

Four hundred and fifty-five working days, more than a year, will henceforth be saved yearly on Oklahoma City switchboards, by having operators omit the word "party," repeating numbers.

A number is now "Walnut 9999-J. Not "party J."

Although "party," enunciated by the subscriber and repeated by the operator, uses up only three-fourteenths of a second, according to the computations of Jasper M. Allen, district traffic chief, yet with 300 operators it totals 10 hours a day. Ten hours a day is equivalent to the working time of one and one-fourth operators.

An operator handles about 300 calls an hour. The exchange handles approximately 170,000 calls a day. Three seconds are allowed for the conversational part of each call. Only 60,000 of the calls are on party lines.

Time saving is not the only advantage gained by the innovation. Psychological tests have shown in digit memory work that an added syllable or digit increases the strain on memory noticeably.

Elimination of two syllables will also decrease the number of mistakes.

Kansas Business Concern to Try Wireless

Negotiations for installing the first wireless telephone system between Oklahoma City, Wichita, Topeka and Kansas City are under way. The Lumbermen's Supply Company expects soon to be taking business by wireless with its offices in these cities.

"The only way to prove the practicability of the system is to install it and give it a trial," said H. B. Gilkeson, manager of the Wichita office. "If it proves successful we can save thousands of dollars a year, that otherwise would be expended on long distance calls and railroad fares. The business necessitates a good deal of correspondence and we can accomplish our purpose in just half the time and cut the expense just half in two."

The Telephone in Foreign Countries

Items of Interest from All Points of the Compass

By G. P. BUNKER

Discusses Wireless News in Europe

All the press organizations of Germany, the representatives of all publishers' organizations, the official Wolff Bureau, the Dutch news agency "Trans-ocean," and the German wireless propaganda service, gathered in Berlin recently for a discussion of the wireless possibilities in Germany for transmitting news.

Dr. Bredow, who conducted the conference, stated that there have been distributed daily a report of the Assembly at Weimar, and news summaries by the Wolff Bureau and Dutch agency. The news messages have been received by the government of the country and turned over by the wireless stations at various points to papers. The conferees concluded that the wireless is not yet able to supply the full needs of the press nor anywhere near it, for the wireless stations are overloaded with personal messages. However, they decided that the wireless is capable of handling brief flashes on important stories which are paralleled by telephone or telegraphed by the news agencies, so that the news is available for a larger circle of people.

The conference was convinced, however, that the spreading of such messages can be done in large numbers only when the wireless telephone has been installed, as only in this way the hiring of special wireless operators can be avoided. They decided that for the present the sending of news will have to continue by telegraph, for it was too expensive to fit up each telegraph office with wireless equipment.

In a few weeks the group will meet again to discuss any further technical experiments referring to wireless telephony.

Bolshevists in Moscow Reduce Service

Under the Bolshevist order socializing the telephone system of Moscow, the number of instruments has been reduced to 15,000, for "technical reasons." In putting this order into effect the Bolshevist officials cut the number of their own telephones only 25 per cent, while factories and similar establishments must be content with half as many instruments as before. The theory every house is to have a telephone, which is to be located on the stairway, where it is to be accessible to everyone in the house and may be used free. If the neighbors have no telephone in their house they are entitled to make use of the one nearest to their abode. If there remains a surplus of instruments after all the houses are equipped, then doctors, nurses, and the higher Soviet officials may have telephones installed in their own homes.

Mexico Talks to Chile by Wireless

Wireless communication between Mexico City and Santiago, Chile, has been established, and the Mexican legation in the latter city is receiving approximately 2,000 words of news daily, which is transmitted from the huge station at Chapultepec to a receiving station in Santiago. Fernando Cuen, Mexican minister to Chile, publishes a daily news letter which, is available to all interested Chileans.

New Bulgarian Telegraph and Telephone Rates

Beginning November 10, 1919, a new schedule of domestic rates goes into effect in Bulgaria, affecting the telegraph, telephone and postal services.

The new rate for telegrams is 20 stotinki (4 cents) per word, with a minimum of 2 leva ($0.386). Double rates are charged if receipt is demanded.

Telephone subscribers are divided into three classes. In the first class are included Government offices and private houses; in the second class, mercantile establishments and the offices of physicians, lawyers, editors, printers, etc.; the third class comprises hotels, restaurants, cafes, clubs, theaters, banks, factories, etc. Subscribers of the first class pay 250 leva ($48.25) per year; of the second class, 450 leva ($86.85), and the third class, 800 leva ($154.40). The cost of installation is additional, and varies from 100 to 500 leva ($19.30 to $96.50).

All conversions above are made at normal exchange, 1 lev equals $0.193. At the time of writing, however, the lev is worth only about 3 cents United States currency.

Paris Operators Regret Bad Service

The French telephone service, which is always bad, has recently become almost impossible. It is quicker to take a taxicab and go to see a person than to try to telephone him. Often it takes thirty minutes to get a connection with an office a mile distant. This condition has naturally had its effect upon the manner in which subscribers express their thoughts to the mademoiselles who are charged with the duty of officiating at the exchange.

To set themselves right with the world they had a meeting this afternoon and adopted this resolution:

"We suffer in our professional consciences, for we have a burning and ardent desire to do our work well. It is we who suffer, for it is at the price of superhuman effort that we try to avoid bad service.

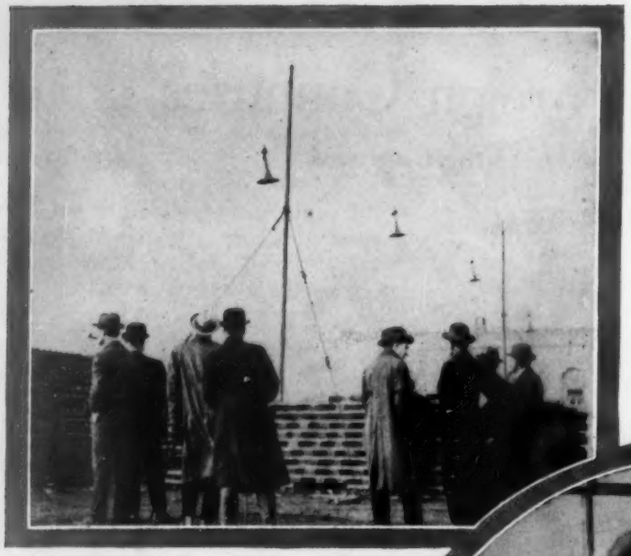
"The installations are insufficient. The material is old and cannot be maintained in good condition because the administration, in the face of increasing traffic, has decreased the number of mechanics. The organization is full of red tape and busy bodies and is out of date."

Telegraph and Telephone Systems of Honduras

The telegraph and telephone lines of the Government of Honduras represent an investment of about $600,000. The length of the telephone line is 1,015 kilometers and the telegraph line, 7,278 kilometers. On January 1, 1919, there were 271 telegraph offices, 372 telegraph instruments, and 512 telephones under government operation. The telephone equipment is American, the switchboards being of the magneto type. Purchases for the telegraph and telephone lines amounted to $12,248 in 1917-18 and to $21,320 in the previous year. Consul C. K. Donald, at Tegucigalpa, states that there is only one private line of importance in his district, that being American equipped and consisting of 150 lines and about 45 miles of wire.

New Loud Speaking Telephone Demonstration in England

Photos by Underwood and Underwood



Newspaper men and engineers listening to music from the multiplex telephone.

Specially designed transmitter for loud speaking telephone.

The amplifying apparatus where the sound waves are changed by the transmitter into electrical waves which are amplified to a strength of high volume.

Personal Mention

Notes of Men Who Are Prominent in the Telephone Fiela

WILLIAM NOBLE, chief telephone engineer with the British postal department, and three members of his staff, A. B. Hart, B. O. Anson and J. Headly, inspected the telephone plant of the Lima, Ohio, Telephone and Telegraph Company. The British government, which controls telephones in England, will spend $65,000,000 in improving telephone facilities.

B. A. Latham, of Freeport, Ohio, obtained authority to sell to the newly organized Freeport Telephone Company, his plant in that village.

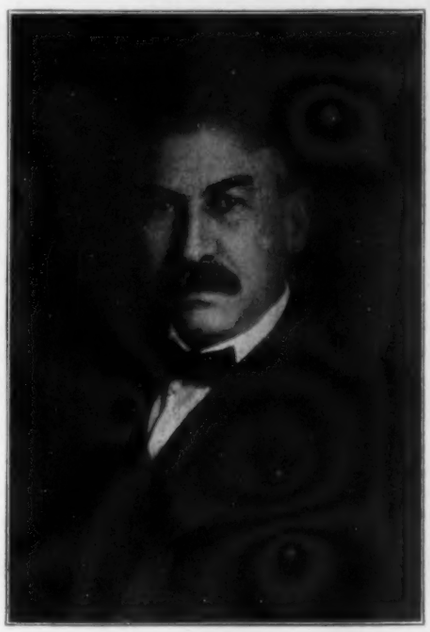
John F. Clifton, appraisal engineer with the Public Utilities Commission of Ohio, since June, 1914, has resigned his position to accept a position on the staff of Gustav Hirsch, consulting engineer of Columbus, Ohio. Mr. Clifton was one of the first appraisal engineers to enter the service of the Public Utilities Commission of Ohio, and has participated in practically all of the appraisals made by the commission in the telephone field in Ohio since 1914. Prior to going with the commission he was with the Ohio State Telephone Company at Cleveland and Dayton, Ohio, on maintenance and construction work in the plant department.

Robert E. Frost, formerly manager of the Tyler, Minn., Telephone Company, has associated himself with the Tyler Hardware and Plumbing Company.

L. A. Frazee, manager of the Connorsville, Ind., Telephone Company, celebrated a quarter of a century of telephone work in Connorsville. On the morning of May 1, 1895, the company began giving service to what then seemed to be a large number of subscribers, which number was one hundred and six. Previous to that time the Central Union Telephone Company had been operating, with a list of patrons numbering fifty-two. Today the list of subscribers of the telephone company has reached the number of twenty-one hundred, not including over one hundred extension telephones and over two hundred factory private branch telephones, making a total of over twenty-four hundred stations.

The development and improvement of apparatus for giving telephone service is shown by the fact that the company now has in operation its fifth switchboard, the first one being a home-made and home-improved affair.

W. G. Brorien, president and general manager of the Peninsular Telephone Company, is rapidly gaining the reputation of being Tampa's champion convention-attender. Mr. Brorien reached home recently after an absence of about three weeks. He went first to his former home, Buckland, O., to visit his mother. From Buckland he went to Winona Lake, Ind., where he attended the national convention of the U. S. Independent Telephone Association. After the telephone men's convention was brought to a close, Mr. Brorien crossed the country to Atlantic City, N. J., where he attended the annual convention of International Rotary.



W. G. Brorien

Several changes in the organization of the Ohio State Telephone Company have been announced. J. C. Boush, formerly state commercial superintendent, has become manager of the Cleveland district, succeeding Gould Williams, who resigned to enter the real estate business. Mr. Boush is succeeded by Mr. Frank McKinney, formerly sales manager of the Ohio State Company. Sam Martin is now manager of the Youngstown district.

H. O. Dutter, manager of the Bucyrus, Ohio, Telephone Company, for the past ten years, has resigned his position and retired from the management of the local plant. His future plans have not been fully determined, although he will probably leave Bucyrus. The vacancy is being temporarily filled by the secretary of the company, Albert G. Stoltz.

Louis H. Helsher, paymaster for the Southwestern Bell Telephone Company, has been continuously in telephone work for more than 45 years.

R. B. Still has been elected president of the Texas Independent Telephone Association succeeding E. C. Blomeyer who will be connected with the Automatic Electric Company, Chicago. Mr. Blomeyer has also resigned the presidency of the Texas Telephone Company of Waco, Texas, and will locate in Chicago.

Frank A. Knapp, president and general manager, The Bellevue Home Telephone Company, Bellevue, Ohio, helped boost Senator Harding at the Chicago Republican National convention, as a delegate from his county. Mr. Knapp says it was certainly some hot job at Chicago, but feels well repaid because of the satisfactory results of the convention. He went direct from Chicago to Winona Lake, Indiana, to attend the sessions of the United States Independent Telephone Association, of which he is a director.

M. B. Farwell, manager of the Wabash Valley Telephone Company, has accepted a position as commercial superintendent of the Texas Telephone Company, with headquarters at Waco, Texas. This is a large concern with a number of exchanges and 42,000 telephones in service.

European Telephone Practice

Translations from the Foreign Press and Communications from European Engineers

By FRED W. SCHOLZ

The Present Status of Telephone Service in Germany

ANNALES des Telegraphes et Telephones prints an article on the present status of telephone and wireless service in Germany at the present time. As this article is dated some time during the Spring of 1920, it is about as late information as can be obtained.

Numerous difficulties are confronting German development of these two branches of public service both on the side of lack of materials as also on the side of lack of properly trained personnel. The installations in service at the present time are unable to meet all demands, which were growing past the capacity of existing equipment even before the outbreak of the war, and have been more or less stagnant since that time.

During the year 1919 applications for 190,000 telephone installations were received by the telephone administration, a figure much higher than the pre-war figure, whose average number of applications during the year was about 125,000. Only 100,000 of the 190,000 applications could be satisfied by connection to the telephone system. On the average only about one new telephone is installed every year and a half, except in cases of official business and in cases of doctors, certain lines of industries and what might be called urgent cases.

The increase in applications has grown in spite of increased telephone rates and in spite of the increased cost of living in Germany, and precludes a fairly satisfactory standard of living. Extension and increase of the equipment of telephone exchanges in such large cities as Berlin, Munich, Dresden, are imperative, but cannot be met, as there is a lack of raw materials needed for this work.

The German government through its telephone administration has placed large orders for all kinds of telephone equipment, but only about one-third have been filled. The low production factor of the electrical industry is due primarily to the lack of coal, as well as to the lack of raw materials owing to the low rate of exchange of the German mark and the lack of good transportation facilities. The coal mines of the Ruhr district and of Silesia produce coal only to a limited extent and have not reached their maximum output since the signing of the armistice. As a direct result it is impossible for the steel works of Germany to produce the high grade iron and steel necessary for manufacture of electrical equipment. Of copper there is less scarcity, as the government has started to recover the copper used so extensively in war equipment. It is lack of coal above all that impedes the recovery of German industry and statistics indicate that only 40 per cent of the normal supply is mined and shipped.

The rigorous application of the eight-hour day has also done its share to reduce output. The state of mind of the workman, who is now dabbling extensively in politics is not conducive towards a large output of production. Finally the numerous weeks and months of revolution and labor unrest have added their portion in keeping output at a low level. When the laborer consents to work, he refuses to take orders from foremen and other superiors and hinders efficient work. Thus for example at the time that a new switchboard unit was being installed in the city of Dresden, a city which uses automanual equipment, it was impossible to use two shifts of men for installing the equipment, each shift working eight hours, because after seven o'clock in the evening there was neither gas nor electricity, nor were any cars kept running, partly on account of the disinclination of the men to keep at work at the power plants, partly on account of the lack of coal.

As regards the personnel of the telephone administration, none of them work more than eight hours a day. The telephone operators work only 42 hours per week. The excess demand made on the telephone exchanges by service conditions and the lack of trained operators adds to the feeling of independence of the operators and they refuse to work longer or more hours in spite of all inducements made to them in the shape of better working conditions, large bonuses and rest rooms, etc.

Every telephone exchange all over Germany has on the managing board a representative commission made up of all branches of the personnel on the exchange staff. The working of the committee is somewhat as follows: The commission constituted of the representatives from the various branches of the exchange staff must be consulted without question by the directors and managing board upon all questions involving hours of work, organization of service and kindred matters. These commissions also express the desires and wishes of the staff and make suggestions and proposals. The managing director need not necessarily follow out the suggestions, but he must listen to them and weigh them before making a decision.

The efficiency of the telephone staff is very much worse than it was in 1914 and is at a very low status. Up to 1914 the work of the operators was modeled on the American plan. An outgoing operator was required to handle 180 communications per hour in the large cities and an operator taking care of incoming calls was obliged to handle 450 calls per hour. Since the armistice these figures have been reduced to 70 per cent of the former output, partly because perhaps the personnel is more easily fatigued, or perhaps because the staff has been recruited during the war by new units who are not as well trained as the older operators and have as yet not reached the co-ordination so necessary to do good work. The telephone service at the present time is pronounced to be worse than poor.

The German telephone administration, however, has made plans of development that closely approach the status of normal times. As a matter of fact it is surprising to see how utterly the bureaucratic system ignores the actual abnormal times and issues orders just as if times were normal. Seven new telephone exchanges have been provided for in plans for Berlin alone, not the present manual system, but complete automatic equipment. Installing this automatic equipment under conditions as they reign at the pres-

ent time, and presumably for some time to come will take easily twenty five years. Besides, there exist at the present time in Berlin ten telephone exchanges which are practically new and which could not be scrapped quickly owing to the lack of labor to scrap them and the waste of capital invested in this present equipment. The experience of Dresden with its automanual equipment serving some 80,000 subscribers has been good, in spite of certain conditions which made service difficult at times. This Dresden installation employs about sixty operators during rush hours, each of them taking care of about 400 calls per hour, which is the maximum output reached for this type of equipment. But with the ever growing demands of the Dresden people for telephone service this installation is insufficient to meet the needs and the reply "busy" is given to practically one-third of incoming calls, as there are not enough wires to take care of the telephone traffic. Moreover the equipment requires mechanics of the highest order; the installations must be kept free of dust and parts of the apparatus out of order must be taken care of at once, in order not to disrupt service.

Errors and interruption of service are more numerous in the automatic system than in the manual systems, but their duration is shorter, for in this system, when the subscriber has come upon a wire which is out of order he recommences to seek another wire and connects himself over another open line. Automatic equipment of small capacity has been installed and used in Germany in small municipalities with great success. Their capacity as a rule is less than 100 subscribers and enables the installation of telephone service where it woud not pay to have an operator employed all the time. The Siemens and Halske works are the manufacturers of this small type equipment, using for it the same style mechanism as is used for the real large installations. The same firm has also standardized a system based on the Strawger automatic system, also in small units.

Aside from the interurban telephone lines, which we might call long distance lines, even though distances in Germany cannot even approach distances as we have them with us, the German telephone system comprises only one telephone cable for any longer distance between Hanover and Berlin. Most of the overhead lines for long distance work are of course Pupinised. The telephone cable just mentioned was to be extended to reach Cologne, but owing to the troubles brought about by the war, this was never carried out. The working of the cable is satisfactory enough, the cable having 2 and 3 mm. copper conductors without telephone relays. The German administration also possesses and operates a submarine telephone cable between Stralsund and Malmoë, Sweden. This is a Krarup cable, which also serves for the telephonic communication between Stockholm and Berlin. For this purpose telephone amplifiers are used at the Malmoë exchange, made necessary owing to the large weakening effect of the Krarup cable. Communication over the cable is very good.

During the war numerous tests were made with telephone relays for use on overhead lines and a type was finally evolved, having twin amplifiers with artificial lines representing the impedances on the two outgoing and incoming sides of the line. The administration has made plans to establish an extensive system of interurban telephone underground cables provided with telephone relays. These telephone relays are to be modeled on American lines. Pupinisation will be average. Although these lines will cost quite little, the Germans have decided to install them in order to furnish first class telephone service between cities, and to invite a large portion of international telephone service passing through the continental countries of Europe to use German equipment. Telephony with four wires (Van Kesteren system) has been tried during the war and has succeeded in establishing an excellent telephonic communication between Berlin and Constantinople.

Very interesting experiments with simultaneous telegraphy and telephony were carried on during the latter part of the war in Germany and a combined circuit has been in use between Hanover and Berlin since December, 1919. Another similar circuit was installed between Berlin and Frankfurt.—*Annales des Telegraphes et Telephones.*

Repeating Coil Transmission Loss

Test Results of Several Types of Coils in Common Use.

By H. M. BOLLINGER

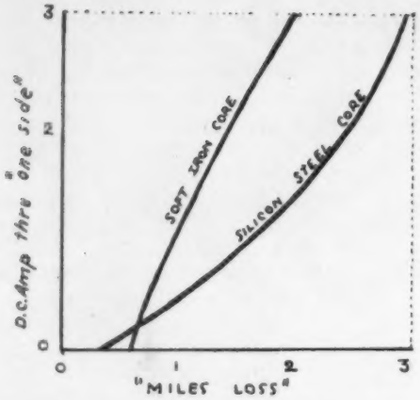
REPEATING coils are usually rated as having a certain approximate transmission loss, determined by comparison of the "through repeating" 800 cycle loss with the 800 cycle loss of a "standard mile of cable" of .054 M.F. capacity and 88 ohm loop, under certain terminal conditions.

That the value thus indicated is sufficiently correct for approximating "dry" circuit transmission loss in actual service is beyond question, but for approximating the losses of circuits in which battery current flows through repeating coil windings, the use of these figures, uncorrected, often results in greatly underestimating the actual repeating coil loss.

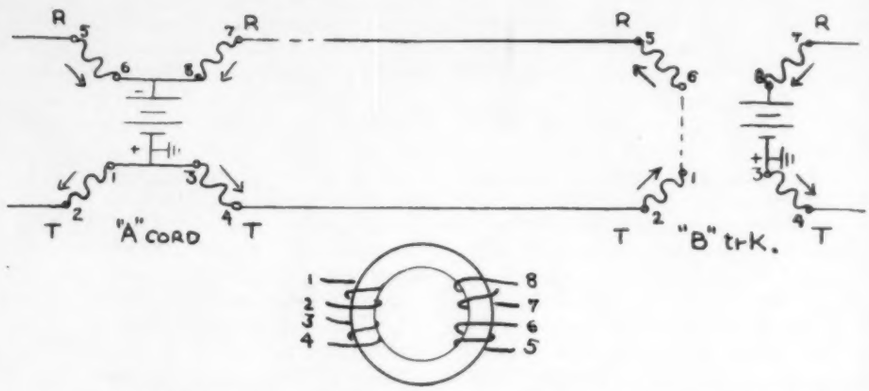
The inductance of iron core coils is commonly known to be less with large currents than with small currents, but it is not generally appreciated that this phenomena is often a very salient factor in telephone transmission.

In the curves are shown test results of 800 cycle loss of two coils of types in common use, one with soft iron core, used quite generally in "A" cord and "B" trunk circuits, and the other a high 16 cycle ringing efficiency coil with a silicon steel core, which is widely used for toll lines and special circuits requiring a "ring thru" characteristic. The coils are of toroidal core construction each having four windings, two on a "side" (in a circuit sense), each winding being about 21 ohm resistance. The coils are designed for unity ratio. The "pots" containing these coils are of the general form of the circular plinth, approximately 3⅞ inches in diameter and 2 1/16 inches deep, mounted on a thin wood base carrying the terminals.

The amperes indicated as thru "one side" may also be the *sum* of the battery currents in both "sides" if



Repeating Coil Losses When Connected to Medium Impedance Lines with Different Battery Current Flowing.



Schematic of Winding Currents of "A" and "B" Repeating Coils as Commonly Connected.

they flow in directions tending to additively flux the core, or may be the *difference* between the battery currents in the two "sides" if they tend to oppositely flux the core.

From the curves it is interesting to note that the transmission loss is less in the high ringing efficiency coil than the common cord circuit coil when no battery current is flowing, but when the battery current exceeds .02 ampere its losses are *greater than the common cord circuit coil.*

The soft iron core coil is ordinarily assumed to have a .5 mile loss and the silicon steel core coil to have a .3 mile loss. The test values of .6 and .4 mile loss shown in the curves at zero current check reasonably close with the assumed loss.

It will be seen from the curves that with .3 ampere flowing in one side of the coil these values are increased 333 and 750 per cent respectively, and that the divergence from the commonly assumed loss is therefore a very significant factor.

In actual service, currents of the order of .3 ampere flow thru one side of an A cord of B trunk repeating coil, when it is connected to a short trunk from a nearby P.B.X. having repeating coil cord circuits, or when connected to some local trunk not provided with current limiting resistances. Under these conditions the excess loss *also* occurs in the connected circuit repeating coil, and in both of these coils may be further increased by the fluxes resulting from the currents in their other windings.

H. M. Bollinger.

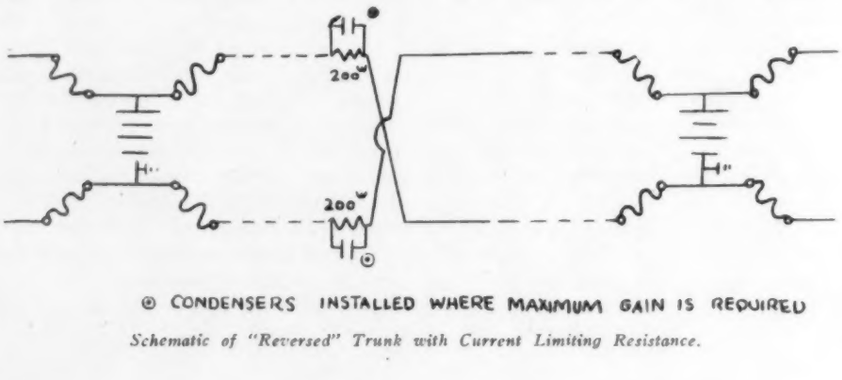
It is of interest that "A" cord repeating coils are generally connected so that the fluxes of the two currents are additive, but that "B" cord repeating coils, when the trunks are normally poled, generally have the condition of opposing fluxes.

From this it would seem feasible to connect all battery feed repeating coils carrying direct current on both "sides." and particularly the "A" cord repeating coils, so that their direct current fluxes would be opposed, and in this way realize a very considerable decrease of transmission loss. To do this would naturally slightly increase the bus bar cross talk of the "A" cords, but probably in an entirely insignificant degree.

A further gain from so connecting the coil windings would be a decrease in side tone at most types of stations, as the excess repeating coil loss, from the direct current flow in the coil windings, is of the nature of a bridged load (and not as a series impedance), which tends to confine the telephonic impulses to their originating end.

The curves indicate the desirability of keeping the direct currents thru repeating coil windings as low as practicable.

The introduction of two hundred ohm resistances, one in the tip, and one in the ring, of a short "reversed" trunk line used between repeating coil cord circuits usually results in a *transmission "gain" even if these resistances are not individually bridged with condensers,* because the loss due to the excess current effects is *greater* than that of the added four hundred ohms of non-inductive resistance.



Schematic of "Reversed" Trunk with Current Limiting Resistance.

Tales of the Telephone

Bits of Humor and Verse With a Story or Two

Hello!

With a clamp on her head like a cage for her hair,
She sits all the day on a stiff little chair,
And she answers the calls that come over the wire

From people of patience and people of ire;
And "Number?" she queries of noble or churl—
A wonderful voice has the telephone girl.

She has to be pleasant, and hustling and keen,
With a temper unruffled and ever serene;
There are forty-five things she must think of at once,
Or someone impatient will call her a dunce.
It's wearisome work on the nerves and the brain,
Continual hurry, continual strain,
And of course she gets tired—as other folks do—
And needs to be thoughtfully treated by you;
So think of her doing her best 'mid the whirl,
And try to be white to the telephone girl.

* * *

Miss Myrtle Olson, operator at Harvey, North Dakota, had the following conversation with the wife of a subscriber recently from Russia:

Mrs. Subscriber—(Taking receiver off hook.)

Operator—"Number, please."

Mrs. Subscriber—"Hello, Middle" (Russian name for Central).

Operator—"Number, please."

Mrs. Subscriber—"Hello, is dis der Middle?"

Operator—"Right, this is the Middle."

Mrs. Subscriber—"Hang de Doctor Coe on de telephone, vill you?"

* * *

A lineman working on rural lines in a community settled by foreigners was hailed one day by a man who said: "Is dis da phoon man? Is dis da phoon man—yah? I want you to feex by phoon. He ban seeck."

* * *

I don't see how ever they know it,
But picture-play actors all do it;
They don't have to look
In a telephone book,
But grab up a phone and go to it.

* * *

A man named Dodgin was recently appointed foreman at a telephone exchange, but his name was not known to all the employees. One day while on his rounds he came across two men sitting in a corner smoking, and stopped near them.

"Who are you?" asked one of them.

"I'm Dodgin, the new foreman," he replied.

"So are we," replied the other workers. "Sit down and have a smoke."

* * *

Apparently the gold medal for extreme miserliness will have to be awarded to the commuter who, on leaving his wife in the morning, forewarned her thus:

"I may have to work late tonight, so in order that you won't worry, I'll telephone you at 6 o'clock. But when you hear the bell, don't answer it—you will know what it means, and I will get my nickel back."

The boarding house 'phone always groans when it sees a pretty girl become a guest. It knows that means work.

* * *

Telephone man at lunch counter—Gimme a hamburg steak, gimme a

hamburg steak, gimme a hamburg steak, gimme a hamburg steak!

Counter Man—What's the matter, young feller? Shell shock?

Telephone Man—Shell shock, nothing. I used to be a supply clerk and we always made out our requisitions in quadruplicate.

* * *

Recently when an operator answered a line signal, a subscriber said, "Operator, I don't want you to think I'm an express train coming. I want 22-22."

* * *

"Are you sure you loved your neighbor as your self," asked St. Peter, who was cross-examining a new arrival.

"Yes," answered the applicant for a golden crown. "For ten years he used my telephone to carry on his business, and I never complained."

"Enter, my good man," said St. Peter with much feeling.

* * *

"Here's a charge for a call lasting half an hour on our telephone," said the lawyer to his wife.

"Yes, dear. That was my call. I was asking a friend of mine a question," replied the wife.

"And did it take half an hour to ask a question?"

"Yes, dear. You see it was one of those hypothetical questions."

Brevities of the Business

The Activities of the Whole Telephone Field Told in Short Paragraphs

ARKANSAS

Alfred G. Kahn, vice president of the Hotel Marion Co., Little Rock, was given a rigid cross-examination by members of the Arkansas Corporation Commission in the case of the commission against the company in regard to the 10-cent local telephone rate being charged by the hotel from its rooms. In his testimony Mr. Kahn introduced a recapitulation for the last six months of 1919, which showed that the company had lost $1,964 on its telephone service although it had charged a 10-cent rate during that time. He said that the cost of operating the exchange had increased materially before the 10-cent rate was put into effect.

ILLINOIS

The Citizens Telephone Company, of Decatur, has petitioned the Indiana public service commission to increase its capital stock from $50,000 to $125,000. The additional $75,000 will be issued in common stock.

The State public utilities commission has issued an order authorizing the Winnebago County Telephone Company to purchase the Central Union Telephone Company property in Winnebago for $8,000. This will end the two line telephone service to the village of Winnebago. The two lines will be consolidated at once.

The Deer Creek Telephone Exchange has been sold, permission being granted by the State utilities commission. The purchase price was $25,000, and the new purchasers intend to issue stock to that amount. W. W. Mercer, president of the telephone company, appeared at the hearing in Springfield in the interest of the company.

At a meeting of the board of directors of the Mutual Telephone Co. held at Hillsboro the following were elected: David S. Grisham, Farmersville: W. H. Morain of Irving and W. B. Wright, Nokomis. The directors will meet to organize later.

The Lincoln Telephone Co.'s application for an increase in rates was given a hearing recently before Examiner George P. Ramsey of the Illinois State Public Utilities Commission at Springfield. It was brought out at the hearing that the Lincoln Telephone Co. has not raised its local rates in seventeen years. In the company's original charter it was provided with an increase when the number of subscribers should reach 1,200, and another increase when the number reached 2,000. Neither of these increases was granted, altho the company has passed the 2,000 subscriber mark.

J. C. Poole, manager, and C. E. Gullett, director, were present at the hearing for the company.

INDIANA

Telephone rates were increased in Elkhart and Goshen by an order of the public service commission today. The commission denied that part of the petition asking for increases in Wakarusa. The order was issued as a result of a hearing held in the court house at Goshen by a member of the commission.

Thirty employes of the Goshen exchange and fifty employes at Elkhart of the Home Telephone Co., have been granted an increase in wages amounting to from fifteen to twenty per cent.

In a protest against the recent rate order of the Public Service Commission filed with the commission by the Southern Telephone Co. of Indiana, the company announced that it will, as soon as possible, file petitions for increases in rates at Evansville and in other exchanges it operates in Indiana. The valuation placed on the Evansville exchange is insufficient, the protest says, and the rates allowed will not "enable the company to establish and maintain its credit and discharge its full duty to the public." In the rate order issued last month the commission authorized the company to continue the Burleson rates generally, but denied an increase over the Federal rates in Evansville.

The Middletown Telephone Co. petitioned for an increase in rates and for authority to establish toll charges from the Middletown exchange to the exchanges at Cadiz, Daleville, Mechanicsburg and Sulphur Springs. The net exchange rates asked are as follows: Business, individual, $2.75; residence, individual, and rural, party, $1.75.

Incorporated: Oaklandon Mutual Telephone Exchange, Oaklandon; capital, $2,000; to operate telephone exchanges. Directors, R. V. Bruce, William Combs, Albert Sigman, Birt W. Apple.

KENTUCKY

Special Master S. M. Hulle of Louisville, sold the Bowling Green Home Telephone Company's plant for $40,000 to the Central Home Telephone Company of Louisville, the present owners. Hulle was appointed by the Federal Court. The plant will continue in operation with Hubert P. Myers as local manager.

Thos. A. Combs, president of the Fayette Home Telephone Co. of Versailles appeared before the court and asked that the court approve the new rates of the company to subscribers under the Fiscal Court franchise outside of Versailles, asserting that the company could not and would not operate at the old rates and refusing to repair and operate those phones put out of order by the sleet. Finally a committee consisting of J. E. Harris, L. S. Johnson and W. H. Wilson, with attorney Jesse, were appointed to try and agree and to report at a meeting to be called later.

Michigan

Lawrence Mutual Telephone Co. has taken over the Van Buren county lines in Lawrence and hereafter there will be only one line.

A $12,000 bid for the franchise and equipment of the Cass County Home Telephone Co. by George W. Phillips, banker here, was the only one received, when the company was sold by order of the United States district court. The company defaulted in interest on its bonds and its insolvency was declared. A petition to close out the company was made by the Michigan Trust Co., trustee for bondholders. The company was organized ten years ago. The equipment was recently appraised at $60,000.

To improve service the Michigan State Telephone company has rearranged its organization throughout the state from one of two divisions and five districts to one of four divisions, with headquarters at Detroit, Lansing, Saginaw and Menominee. The change was made to bring department heads in closer contact with the service under their control. The old Kalamazoo and Jackson dis-

tricts have been combined in the southern division with headquarters at Lansing, over which A. J. Peckham of Detroit, becomes superintendent. Ben. R. Marsh and Lew J. Walley of Detroit were transferred also to the southern division. A. E. Huntley, superintendent at Saginaw, will take charge of the central division.

The Michigan public utilities commission issued an order which increases telephone rates for the city of Detroit 38 per cent, based on a requirement that better service be given. Business phones will be increased from $4 a month to $6 a month with 100 calls allowed and 5 cents for each additional call, and four-party line residence phones increased from $2 to $3 and 5 cents for each extra call above 50 a month.

Minnesota

St. Paul telephone subscribers will continue to pay war-time rates fixed by A. S. Burleson, postmaster general, while the Tri-State Telephone & Telegraph company was under federal control, the State supreme court ruled in the absence of new rates imposed by the State railroad and warehouse commission.

Missouri

The increased telephone rates granted the Kansas City Telephone Company by the public service commission have become effective. The monthly charge for business telephones was advanced from $5 to $8 and the charge in residences was increased 50 cents a month. When the new schedule became effective the company announced an increase in wages to its employes.

The Butler and Rich Hill telephone system, owned by F. M. Campbell, was sold to A. J. Erhart of Roselle, Kan. The consideration was nearly $100,000.

NEW YORK

Telephone service in apartment houses and hotels in New York is a utility and not a facility, according to a ruling made in Albany by the Up-State Public Service Commission, which orders the New York Telephone Co. to file a new schedule of rates applicable to such places.

This ruling will prevent the public being gouged by hotel and apartment house owners for telephone calls made from the building. It has been ascertained that an illegal profit of forty per cent and upwards has been made on such calls.

The new rates are to cover hotel and apartment house service and the company is allowed until May 1 to file the schedule, which will become effective June 1. The decision, from which Commissioner Frank Irvin dissented, in part, follows:

"When a public utility installs its telephone system within a hotel or apartment house it is installed there as a part of the public utility system and is extended to the various rooms to reach the consumer of the utility company's product. The proprietor is charging not for service of a hotel facility character, but is charging for service of a public utility character. This latter business the proprietor has no legal authority to conduct. Hotels or apartment houses are not public service corporations."

The decision was the result of complaints against the Astor Hotel, the Plaza, two large west side apartment houses and the telephone company, and involved the right of proprietors to charge rates in excess of those fixed by the company.

Prepared to erect an automatic telephone exchange in West Seventy-third street, between Columbus and Amsterdam avenues, to relieve congestion in the Columbus, Riverside, Circle and Schuyler districts, the New York Telephone Co. finds itself confronted with the recent zoning ordinances under which the area so badly in need of relief, is restricted to residences.

Ohio

A sneak current of low amperage and high voltage recently developed a blaze in the local exchange of the Tuscarawas County Telephone Co. at New Philadelphia. The insulation was burned off the line jacks in one section of the switchboard, 150 telephones being put temporarily out of commission.

City Administrator W. J. Laub, Mayor Carl Beck, Law Director Henry Hagelbarger and members of the municipal committee of the Chamber of Commerce, of Akron, recently considered the petition of the Bell Telephone Co. for higher rates. C. P. Bradford, district manager of the Central Union Telephone Co., was present to represent the telephone company. Hugh Allen is chairman of the municipal committee, together with Jerome Dauby, Fred M. Harpham, John W. Gauthier and Charles Herberich.

The Murphysboro Telephone Co. was ordered by the public utilities commission to take steps at once to provide adequate prompt, continuous and efficient service in Murphysboro and surrounding communities.

The telephone exchange, a theater and ten stores at Woodstock were recently destroyed by fire.

At the annual meeting of the stockholders of the Urbana, Ohio, Telephone Company, the following directors were elected: R. H. Murphy, E. E. Cheney, J. C. Powers and I. N. Keyser of Urbana; J. W. Cherry, W. S. Cater and W. C. Newton of Columbus, and H. E. Allen of Dayton.

The Fremont, Ohio, Home Telephone Company increased its capital stock $25,000. The former capitalization was $200,000 to $275,000 but it is now $275,000 to $300,000.

At the annual meeting of the stockholders of the Ada, Ohio, Telephone Exchange Company, all the old directors and officers of the company were re-elected, with the exception of Justin Brewer, who declined. C. L. Brewer was elected in his stead. The officers are: President, George Rothrock; vice-president, Dr. R. P. Coppess; treasurer, Justin Brewer; secretary and general manager, D. H. Herring; directors, Fred Montville, William McElree, Dr. R. F. Coppess, George Rothrock, C. L. Brewer, H. A. Clark and D. H. Herring.

Oklahoma

At Strong City, Oklahoma, A. A. Hitchcock, John Simpler and A. A. Steanahan have incorporated a new telephone company, to be known as the Strong City Telephone Company, with a capital stock of $2,400.

A merger of the Southwestern Bell Telephone Co. of Oklahoma with the organization in Kansas, Missouri, Arkansas and Texas is under consideration, according to Art Walker, chairman of the state corporation commission. The companies hope to finance much needed extensions more readily by the merger. The commissioner indicated that the commission would interpose no objection to the combine, provided it retains its supervisory powers in this state.

Extensive improvements in the telephone service in Muskogee were recently announced by District Wire Chief Baldwin. More than 30,000 feet of underground duct, the equivalent of 30 blocks of installation and 15,000 feet of additional underground cable will be installed in the near future. Thirty-seven miles of aerial

cable will be erected chiefly in the suburbs.

Members of the Oklahoma state corporation commission recently conferred in Kansas City with similar commissions from Kansas, Missouri and Arkansas to devise uniform regulations for the operation of telephone lines in the southwestern district. Such regulations, according to Art Walker, chairman of the Oklahoma commission, will eliminate many of the complaints being lodged against the telephone company by subscribers in these states. "Conditions of telephone service in all the states of the southwest are identical with those in Oklahoma," Mr. Walker said. "Numerous complaints have been filed with the commissions charging the companies are not giving efficient service. Now that the companies are no longer under federal control, the commissions will have more power in dealing with them."

SOUTH CAROLINA

The completion of the telephone line from Chester to Great Falls is an event of much local interest.

The Gapway Telephone Co., of Andrews, has been commissioned. The proposed capital is $15,000. W. T. Evans, N. W. Cook, M. L. Boyd, R. C. Marshall, J. J. Marshall, and L. A. Parson are the incorporators.

TEXAS

The Peoples Home Telephone Company, with headquarters at Sherman, Texas, of which C. A. Shock is one of the principal officers, has sold its exchange at Valley View to W. W. Pitts of Wylie, Texas. On account of this exchange being located quite a distance from Sherman, the former owners decided that they would dispose of the property. The new owner took possession immediately and will manage the exchange. This makes the third or fourth exchange disposed of by the Associated Independent Companies, whose headquarters are at Sherman, and of which H. W. Head is president and C. A. Shock is manager.

The city commission at McKinney, recently passed an ordinance setting telephone rates at $2 per month for residence and $4 for business telephones. This was done after the Southwestern Bell company had notified the commission that beginning July 1 it would charge $2.25 for residence and $4.50 for business telephones.

Because the Southwestern Telegraph and Telephone Co. failed to install a telephone in his residence at 1012 Houston avenue, Beaumont, Dr. J. R. Bevil brought suit for damages of $500 in Judge McDowell's court, and asked a mandamus compelling the telephone be installed. The petition says the plaintiff ordered a telephone August 1, and that nothing has been done about it yet. Loss of telephone service to him is worth $25 a day, Dr. Bevil says.

The city council of El Paso, Tex., has ordered that the Tri-State Telephone Co. be permitted to continue the rates established under government control. The conditions are that the company shall improve its service, not reduce wages, and allow a city representative to inspect its book quarterly if desired. Present rates are $7.50 monthly for business telephones and $2.50 to $3.50 for residence telephones.

Stockholders of the San Marcos Telephone Co. recently re-elected the following directors for the ensuing year: G. W. Donaldson, president; I. W. Wood, vice-president; Morton Swift, secretary-treasurer-manager; Lloyd Johnson, Dudley C. Johnson.

The treasurer's report shows a net profit of $163.67 for the year 1919 and a fair valuation of the amount invested in the plant and equipment is about $53,000. The telephone company claims they have been running at a loss for the past few months and expects to petition the city council for authority to increase the rates sufficiently to make a reasonable return on the investment.

The telephone operators of Ft. Worth are said to be considering a plan to make the Sabbath a day of rest.

VIRGINIA

Refusing to grant permission to the Clifton Forge Mutual Telephone Co. to increase its rates in Clifton Forge and Covington, the state corporation commission expressed the opinion that the company is making enough money already. The rates were increased $6 per year by the postmaster general under federal control, and the company asks for a further increase of $6 per telephone per year.

The city council of Bristol, Va., recently passed a resolution directing the city manager to notify the owners of all telephone, telegraph and power poles having poles on Moore, Front, Lee, Cumberland and Water streets to take such steps as will enable them to remove the poles prior to the paving of those streets.

WISCONSIN

The Eau Claire County Telephone Co., with an exchange at Union, has applied to the railroad commission for authority to increase its rates to $1.75 per month straight with a penalty of 25 cents per month if not promptly paid.

The Wausau Telephone Co., which recently increased its capital stock from $100,000 to $300,000, has asked the Wisconsin railroad commission for permission to place $160,000 of its stock on the market to get funds for extensions and improvement of service. The company, which operates an automatic system, has about 7,000 subscribers. It operates several rural lines and proposes to extend them. For the twenty-sixth consecutive year the same directors of the company have been reelected.

Telephone companies earned more last November than during the same month the year before, according to figures made public recently by the Interstate Commerce Commission. Net operating revenue for 64 companies in November was $8,950,424, an increase of $939,308 over the net operating revenue in November, 1918. Gross revenues for November totaled $36,576,181, an increase of $6,821,083 over the preceding November. Operating expenses aggregated $27,625,757, compared with $21,744,082 in November, 1918.

A court decision to the effect that a telephone company must give service or stand the consequences in the form of assessment of damages, was handed down in a Milwaukee court in a claim recently brought against the Wisconsin Telephone Co. In the event the latter appeals it will be interesting to follow the progress of this case through the higher courts.

The Oakfield Telephone Co., Fond du Lac, has issued a statement as to its income for the past year, according to the provisions of a new law passed by the last legislature. A net income amounting to $2,857.48 is shown for the year 1919. Subscriber telephone earnings totaled $8,035.65, while toll line earnings amounted to $1,325.07. Commissions and government charges brought the total operating revenues up to $10,006.32. Operating expenses totaled $6,946.59, leaving a net operating revenue of $3,059.73. Non-operating revenue amounted to $2.45, making a gross income of $3,062.18. Interest on floating debt totaled $204.70, leaving a net income of $2,857.48. The balance sheet for December 31, 1919, shows a total of $28,832.67 invested in equipment, plant and accounts.

Of Interest to the Trade

What the Telephone and Accessory Manufacturers are Doing to Advance the Art

Poole's Practical Telephone Handbook

THE sixth edition of Poole's Practical Telephone Handbook has recently been issued by Sir Isaac Pitman & Sons Ltd., London. In the preface to this edition the author states:

"The remarkable development in the art and practice of telephony which has taken place during the last decade, and more especially during the last five years, has necessitated the complete rewriting and rearranging of the edition of this book published in 1895. The present edition has more than twice the amount of letterpress matter, nearly 200 more illustrations, and the size of the page is enlarged. Such enlargement has been needed owing to the greatly increased scope of the art, which has followed from the general adoption of central-energy methods of working exchanges, and the greater complexity of the plant. It is, perhaps, not too much to say that, within the period mentioned, there has been a greater revolution than has taken place in any other technical business in the same time.

"The apparatus used, especially that in exchanges, has, to a large extent, now become standardized, so that whilst in the future there will, no doubt, be many improvements, those made will, it is believed, more likely be in connection with smaller details than with the general principles, unless some very great advance in automatic exchange working should lead to its general adoption, which, however, is not considered likely by the writer.

"This standardization, and the general adoption of central-energy working, has led to a more scientific study and treatment of the problems involved, especially in connection with traffic and the designing of exchanges.

"The necessities of central-energy working and the line-loading arrangements of Professor Pupin and others have also led to more definite appreciation of the value of the best line-construction, and to the better designing of lines for economical transmission.

"Speaking generally, only instruments, etc., practically in use have been described, but exceptions have been made where some special principle is illustrated in the apparatus described.

"The very large scope of the art has rendered it necessary to adopt the division-of-labor principle, and divide the staff into various classes, as it is almost impossible for any one man to make himself familiar with all the various branches. These divisions are such as: Overhead Engineering; Underground Engineering; Switch-Board Equipment; Testing Department; Investigation Department; Traffic Department; Operating Department, etc.

"The writer has endeavored to touch on all the engineering departments, but he cannot pretend that he has done so exhaustively, as it would be altogether out of the question for such a work as this is intended to be. The Table of Contents will give an idea of the actual scope of the work."

Columbia Prize Window Contest Popular

PRIZES aggregating $5,000 for the best window displays of Columbia "Hot Shot" Batteries have drawn many competitors into the dealer contest running through the month of May, and the photographs already received show a high order of ingenuity and advertising value in the displays.

In addition to the 124 prizes, from $25 to $200 each, an acknowledgment of $3 will be made to each contestant who sends in one or more photographs, except where a prize is awarded. This will cover the expense of having the window photographed. Pictures must be mailed so as to arrive at the Cleveland office of the National Carbon Company not later than June 12, and awards will be made as soon as possible after the close of the contest.

M. W. Dunton Company Banquet

THE M. W. Dunton Company of Providence, R. I., manufacturers of NOKORODE Soldering Flux, gave a banquet to its employees recently in the ball room of the Crown Hotel at Providence. After dinner the party took the form of a get together meeting which was presided over by Ernest V. Halligan, sales manager. The president of the Company, Mr. Frank Chapman, gave an interesting talk covering his career as the manufacturer of NOKORODE, showing its growth from infancy up to the present time. Mr. Chapman also announced that he had just purchased a much larger factory, to which they would move in the early fall.

Additions to Kellogg Sales Staff

THE several additions to the Kellogg sales force within recent months have enabled this company to cover the telephone field effectively throughout the United States.

Mr. W. S. Boze, Mr. W. R. Kimmel and Mr. B. E. McGregor will represent the Kellogg interests in Nebraska and Iowa exclusively.

Telephone men are assured prompt attention and hearty co-operation from these three men.

Mr. L. F. Kline, who was succeeded by Mr. B. E. McGregor in the Nebraska territory, was obliged to give up traveling and resign his position with the Kellogg Company.

Work for 2,000 in Big O. K. Battery Plant

MORE than two thousand skilled and unskilled men will be employed in the plant of the O. K. Giant Battery Corporation at Gary, Indiana, by the time the eighth unit is completed this fall. Three buildings are now in use, according to Paul B. Rabe, president of the corporation, which is turning out a dry, rechargeable battery.

The contracts call for completion of twelve buildings by December 30 of this year, and by the way the construction is being rushed now, all the units ought to be ready by that time. The corporation has a tract of forty acres, on 37½ of which will be erected forty buildings.

Western Union Telegraph Earnings

The earning report of the Western Union Telegraph Company for the six months ending June 30, 1920, is as follows:

Gross Revenues, including Dividends and Interest	$59,955,000.00
Maintenance; Repairs and Reserved for Depreciation	$ 7,881,000.00
Other Operating Expenses, including Rent of Leased Lines, Taxes and Employes' Income Participation	$44,454,000.00
Total Expenses	$52,335,000.00
Balance	$ 7,620,000.00
Deduct Interest on Bonded Debt	666,000.00
Net Income	$ 6,954,000.00

E. Y. GALLAHER,
Vice-President and Compt.

Note: Operations for 1919 period not stated for comparison; Company under Federal control in 1919 and corporate income derived from compensation for use of land line system, income from Atlantic Cable System, and dividends and interest.

Brorien Again President of Florida Association

Managers of Florida telephone companies attended the thirteenth annual convention of the Florida Telephone Association, which met in the chamber of commerce auditorium at Jacksonville, Fla., with W. G. Brorien, president of the Peninsular Telephone Company, of Tampa, in the president's chair.

The following were present, making the largest number which has ever attended one of the meetings:

W. G. Brorien, president, Peninsular Telephone Company, Tampa.
Ralph Shriner and A. B. Stewart, of Tampa.
J. Ed. Scott, president Arcadia Telephone Company.
E. E. Voyle, president East Florida Telephone Company, Gainesville.
W. U. Lathrop, Bradentown.
S. O. Newsome, Blountstown.
D. H. Petteys, McIntosh.
Dr. W. L. Moor, Tallahassee.
A. B. Green, Tallahassee.
F. W. Webster, Miami.
J. J. Clinton, Fort Lauderdale.
A. J. Walker, Winter Garden.
H. A. Bishop, Starke.
W. H. Hurley, Wauchula.
C. H. Gallaway, Winter Park.
Frank R. Shutts, Miami.
J. H. Wiley, Interlachen.
John C. Lemon, Jacksonville.
C. E. Sudmall, Milton.
W. H. Adkins, Atlanta.

Mr. Brorien was re-elected president of the association, and other officers chosen were Dr. W. L. Moor, of Tallahassee, vice-president; and Frank L. Moor, of Tallahassee, secretary and treasurer. The president was empowered to appoint an executive committee and a standing committee on legislation.

Speakers at the convention included A. B. Green, engineer of the Florida railroad commission; E. E. Voyle, Frank Moor, F. W. Webster, and President Brorien.

Mr. Green brought out forcibly the relation between the railroad commission and the telephone companies. He stated that the commission represents the people and the companies alike and tries to make fair adjustments between the two interests. His address was well received.

2,280 Mile Talk by Wireless Telephone

By wirless from Catalina Island to Long Beach, Cal., a distance of thirty-four miles, and from there by a telephone wire a call came to William Wrigley Jr., chewing gum king, in his Chicago office.

The message traveled 2,280 miles.

It marked the opening of wireless telephone service between Catalina Island and the California mainland. A New York broker now may idle his time on the island and also direct his affairs in Wall street.

So perfect was the connection Mr. Wrigley could hear above the voice at the other end of the call the tinkle of the orchestra on the veranda of the Hotel Atwater in Avalon.

Mr. Wrigley talked in turn with J. H. Patrick, D. M. Benton and John N. Stewart, officials of the Catalina Island Company.

"It was wonderful," said Mr. Wrigley, who talked thirty-five minutes. "The only thing to mar the talk was asking me the score of the ball game, and the Cubs lost."

The telephone call was relayed from Long Beach by way of Los Angeles, San Francisco, Salt Lake City, Denver and Omaha.

Arkansas Telephone Association Meeting

The Arkansas Telephone Association held its midsummer meeting at Hot Springs. The association is composed of 175 companies over the state.

The telephone material situation was discussed following the report of Ernest Sowell of the Southwestern Bell Telephone Company, assistant secretary of the state association, who handles the directories and publicity for the local telephone company. He said that telephone material is very scarce, and that the situation seems to be more acute now than during the war. A representative of the manufacturers spoke of the difficulty of securing material.

C. E. Wright, commercial engineer for the Southwestern system of St. Louis, made a talk on what constitutes fair rates.

Resolutions were adopted congratulating S. A. Lane on his recent promotion to general manager of the Bell companies in Arkansas.

Flint Exchange Opens Operator's Dormitory

The opening of the Michigan State Telephone Company's "Penelope House" at 325 West First Street, was an affair not soon to be forgotten by the Bell girls of the Flint, Mich., office.

For some time past, the telephone company have felt that a home should be provided at a nominal cost for those out-of-town girls who come to the city as operators. And so the company procured the residence mentioned, repapered it, redecorated it all through; varnished the floors and installed all perfectly new furniture and up-to-date fixtures of every class.

The officials state that they have every reason to believe this new home for operators who care to reside there will flourish and prove the solution of a most vexing problem of the past in the matter of accommodation. The girls who occupy this home will pay only a nominal fee; the company will merely charge the actual cost for the rooms and breakfast served.

In all, the home will accommodate comfortably about 30 persons. In the cellar, there is a laundry and upstairs a sewing machine; in the parlor a piano and grafonola—in the den plenty of good clean literature; there seems to be everything required.

Indiana Meeting at French Lick, October 12

The Southern Indiana Telephone Association ,at a meeting held in French Lick, Ind., July 13, decided to arrange for the largest telephone meeting ever held in that section of the state on October 12, at French Lick.

The meeting will be sectional. There will be an operators' meeting at which traffic problems will be discussed; a plant meeting at which the plant men will talk over plant problems, and a managers' meeting at which managers will attend and discuss general problems confronting telephone companies.

All attending the meeting will come together at a banquet either at noon or in the evening and at this time the general talks will be made.

Special music and entertainment stunts with community singing in the evening are being planned, as well as a dance at the French Lick Hotel for all those who can remain over after the meeting has adjourned.

Mobile Has Twelve Per Cent Development

Mobile has more telephones per capita than any other city in the southeastern division, according to statistics obtained from the two local companies. There is a total of 9,600 telephones in the city, 7,000 Bell telephones and 2,600 Home telephones. Upon an 80,000 population basis this gives Mobile a 12 per cent telephone development rate, which means that one person out of every eight and a half has a telephone.

The southeastern division comprises the following states: Louisiana, Alabama, Mississippi, Tennessee, Kentucky, North Carolina, South Carolina, Georgia and Florida.

Wireless Telephones in Salt Lake City

Wireless telephone communication was successfully accomplished between local stations in Salt Lake by experimenters on the staff of the Radio Constructing Company, a local concern, of which Cedric E. Hart is president.

The apparatus used for testing is similar to a set the Ogden Portland Cement Company uses between the plant in Ogden and that at Baker, Utah, five miles west of Brigham City.

Shortly after beginning the test, Ira Kaar a local amateur, reported in with the message, "yes, yes"; "try again"; "sounds very plain." From that call to the end of the experiment the conversation was kept up continuously. The experimenters sang "The Long, Long Trail," "Smiles," "The Star Spangled Banner" and other songs. Heber Nelson, of Station No. 5, picked up the conversation and congratulated the singers on their efforts. Other amateurs in and around Salt Lake also engaged in the conversation.

This is the first time the human voice has been successfully transmitted over this type of radio apparatus in this part of the world, Mr. Hart said.

Associated with Mr. Hart is Salisbury M. Andelin, of Richfield, Utah, who is vice-president of the company.

Both Mr. Hart and Mr. Andelin have been in radio work for five years, the latter in the government service as chief wireless operator in the navy; the former also was with the government in the East.

High-Speed Wireless Transmission

When, probably in the not very far distant future, it has become the normal practice to receive wireless messages much in the same way as ordinary line telegraph messages are nowadays received—that is, in the form of paper-strip inked in the Morse code or printed in Roman character, or when it has also become customary to transfer a wireless message automatically and immediately to land-line instruments, and perform these operations at the same speeds as those now possible in line telegraphy—it will be interesting to have it on record that some of the pioneer work in these directions has been carried out by officers of the British Royal Engineers and other workers attached to them, says the *Electrician*. For some time experiments have been in progress at the Signals Experimental Establishment, at Woolwich Common, and it is now found to be quite practicable to handle traffic by wireless telegraphy at speeds of 100 words per minute, using the standard Post Office type of Wheatstone transmitter with punched tape for transmission and the standard Wheatstone inker for reception. It is obvious that a message which can be made to operate an inker, can also be employed to actuate a printer receiver of the Creed or other well-known type, or to operate a line transmitter, and so translate the wireless message direct on to land lines. The first practical tests of this method were carried out between Woolwich and Bedford in July, 1919, when a speed of 62 words a minute was reached. After other trials, with gradually improved instruments, a prolonged test was made between Woolwich and Weymouth, using quite moderate power. The apparatus was not tried at much over 100 words per minute, but perfect records were obtained at the following speeds:—2,017 words in 30 minutes; 901 words in 8 minutes; 379 words in 4 minutes. Those accustomed to handling wireless traffic will readily realize the value of being able thus to receive at speed on a standard inker, and will appreciate the value of this experimental work. It may be added that there would not appear to be very much difficulty from the electrical point of view in attaining very much higher speeds. The only limit is that set by the exigencies of mechanical design.

Chicago Company Makes Home for Operators

A home for telephone girls with numerous recreations will be established as a means of solving traffic and housing problems.

A fifty-six room apartment building, to house about eighty girls, is being converted by the telephone company into a boarding-house at an approximate cost of $50,000. The dormitory will have a large service kitchen, dining-room, laundry and a number of sewing rooms. Each apartment will be furnished with a phonograph or a piano.

Holds Company Liable For Poor Service

That the Wisconsin Telephone Company may be held liable for failure to give adequate service and that service and assessment of damages is one for the jury to decide and not a case for the state rate commission, was the decision in a test case on alleged poor service instituted against the company in civil court. The decision was by Judge Otto Breidenbach.

Peter Zisch, a telephone patron,

sued for a refund of $121.75 on the ground that the company violated its contract in not giving reasonably adequate service. The company contended the court had no jurisdiction.

Telephone Conversations Are Much Too Long

"Undoubtedly," writes F. P. A. in his "Conning Tower" in the New York *Tribune*, "telephone conversations are too long—the duration of a call has increased 25 per cent in a year. And the Inconsiderate Public is to blame." For example, declares F. P. A., the business man tells his secretary to get Mr. Blooie on the phone. But the secretary gets Mr. Blooie's secretary, and the waste is enormous; thus:

"Mr. Blooie, please."

"One moment." (Operator switches to Mr. Blooie's exchange).

"Mr. Blooie?"

"Who wants him?"

"Mr. Gazish."

"Mr. Gazish on the telephone." (From Blooie's secretary to Blooie).

"Which Mr. Gazish?" (Blooie to his secretary).

"Which Mr. Gazish?" (Blooie's secretary to Gazish's secretary).

"Mr. W. K. Gazish."

"Mr. W. K. Gazish." (Blooie's secretary to Blooie)

"All right. Tell him to wait a second."

"Just a moment, please. Here's Mr. Blooie."

(Thirty seconds elapse)

"Hello, Mr. Gazish?" (Blooie to Gazish's secretary).

"Just a moment, please. Mr. Gazish. here's Mr. Blooie."

"Hello. Who is this?"

"This is Blooie. Did you want me?"

"Yes. Hello, Blooie."

(The conversation is on)

Hints to Telephonists on Writing Poetry

John Lee gave a lecture recently to the London Society of Telephonists on the above unconventional subject, reports the *Telegraph and Telephone Journal* of London, in the course of which he said: "I am not at all sure that telephonists want to write poetry. I am not at all sure that they want anything. Their lives already are so filled with excitement that writing poetry may appear to be a dull business in comparison. However I have to give some hints to them on something. I can hardly tell them how to knit stockings or to make blouses. Stockings, nowadays, seem to be a fact of considerable importance. They need no help to make themselves beautiful. They certainly need no suggestion to speak softly and tenderly on all occasions. There seems to be nothing left but poetry, so I take poetry. It does not mean that I want every telephonist to be a poetess. On the contrary, while I would encourage them to live poetically I am not at all sure that I would encourage them to write poetry."

Nevertheless in the course of an amusing and whimsical paper, Mr. Lee contrived to suggest some "standard expressions," if we may so put it, of which we quote the following examples:

The instruction lamp lights slowly on the board,
The long, long train of operators hear,
They bend in silence, and at length, restored,
The listening keys go back and all is clear.

Behind the chairs they march, the lofty band,
One for our ten, who guard us day by day,
Our mute Napoleonesses whose command
With lowly reverence gladly we obey.

Full many a super-genius of her kind,
Our dark unfathomed twinkling switchboards knew,
Full many a Boadicea, heart and mind,
Born to be rulers, herein bloomed and grew.

A Joan of Arc, slow, stately, firm of will,
A Mrs. Pankhurst, feminist and strong,
A true Corelli, romancing until
The tale was weary and the tale was long.

A Mona Lisa with a witching smile,
Another (loveable) a smiling witch
A Cleopatra who would Kings beguile,
A Dorcas drooping-eyed with stitch on stitch.

These be our goddesses. They come, they pass,
We give them fish knives or a sliver pot,
When the day comes that we must part, alas,
Well, they are human—but we love the lot!

NUMBER, PLEASE

What are you like, whose voice so sweet and tender,
Comes at my calling, answers to my sigh?
Are you a blonde, a Saxon slim and slender,
Are you a Latin, dark and stern of eye?
I seem to know you better by degrees
Each time I hear you murmum, "N'mbr pl'se."
So swift to answer and so kind to render,
Service so faithful, madam, I would give to you
All that a meek admirer should surrender
If but to me your faithfulness be true,
So my impatience would I fain appease
Until I hear your greeting, "N'mbr, pl'se."

Are you in black or brown or fawn or navy?
Have you of stockings red or maybe blue?
Is your coiffure or bobbed or is it wavy?
Thus, somewhat vaguely, must I dream of you.
Whate'er your costume or your colour these
Are trifles to your precious, "N'mbr, pl'se."

Sometime, perhaps, a Fate will overtake you,
Someone will whisper when the shadows fall
That come what may he will not e'er forsake you,
His queen you are—his sunshine and his all.
Then when the wind, too, whispers in the trees
Will come your welcome whisper, "N'm
Will come your welcome whisper, "N'mbr, pl'se."

Will Spend $3,000,000 in Oklahoma

The Southwestern Bell company this year will spend $3,000,000 on new construction in Oklahoma. Of this amount, two-thirds is for extension work and one-third for replacement.

Good service depends to a large extent on the attitude of the public, as well as on the equipment of the company and the efficiency of the operators.

Erection of a new wing of the Pioneer building, Oklahoma City, will be deferred until the spring of 1921, while the company tackles the more pressing business of installing new cables to sections of the city without telephone service.

Oklahoma City has approximately 18,500 telephones. The growth last year was 2,400 telephones.

Marked improvement of service in Oklahoma City will not be possible until next fall when the new automatic telephone exchange at Twenty-third street and Olie avenue will open the northwestern section of the city. Later, the automatic system will be extended to the downtown section.

Believing that girls coming to work with wet feet are a liability, because they may contract sickness, the Michigan State Telephone Company, at the Hillsdale exchange, keeps on hand dry stockings and slippers, to which the girls can change. A kitchenette has also been provided.